2002

This Year at the MOVES Institute (presentation for the annual institute review for the NPS Dean of Research)

Zyda, Michael

This Year at the MOVES Institute

Michael Zyda, Director
zyda@movesinstitute.org

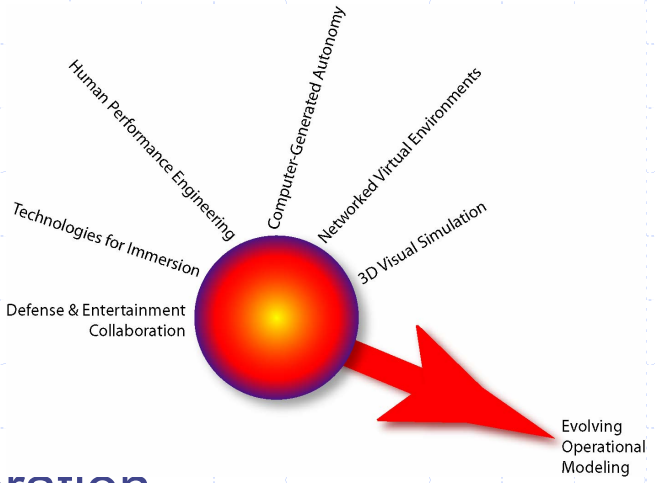
The MOVES Institute

Research Programs

Mission

Research, application and education in the grand challenges of modeling, virtual environments and simulation.

- 3D Visual Simulation
- Networked Virtual Environments
- Computer-Generated Autonomy
- Human Performance Engineering
- Immersive Technologies
- Defense and Entertainment Collaboration
- Evolving Operational Modeling



Organizational Structure

The MOVES Institute
Naval Postgraduate School

Director

- Michael Zyda

Technical Directorate

- John Hiles - Computer-Generated Autonomy
- Don Brutzman - 3D Visual Simulation & Networked Virtual Environments
- Rudy Darken - Human Performance Engineering
- LCDR Russ Shilling, USN - Immersive Technologies
- Alex Callahan - Evolving Operational Modeling
- Ted Lewis - High Performance Computing & Software Engineering
- Alex Mayberry, Creative Director

Executive Advisory Board

Executive Advisory Board provides guidance on funding for research and products.

- VADM Richard Mayo, USN - NETWARCOM
- John McLaurin, Deputy Assistant Secretary of Army for M&RA
- RADM Lee Kollmorgen, USN (ret)
- CAPT Dennis McBride, USN (ret), PhD - President, Potomac Institute
- Dr. Harold Hawkins, ONR
- CAPT Mike Lilienthal, USN - Director of DMSO
- Dell Lunceford - Director of AMSO
- COL Casey Wardynski, Director, Office of Economic & Manpower Assessment
- Gilman Louie, In-Q-Tel
- Dr. Mike Bailey - Technical Director, USMC Training & Education Command
- Michael Kapp - Founder & President Time Warner Special Projects (ret)

Technical Advisory Board

The MOVES Institute
Naval Postgraduate School

Technical Advisory Board provides guidance on technical alternatives to proposed research and products.

- Dr. Phil Barry, DMSO OOTW Technical Lead
- CAPT Rolland Mulligan, USN - Director, Navy Modeling & Simulation Management Office, N61M
- Jim Weatherly - Deputy Director, Navy Modeling & Simulation Management Office, N61M
- LCDR Dylan Schmorrow, USN – ONR VIRTE Program Manager & DARPA Program Manager
- Dr. Bowen Loftin - Old Dominion University, Director Virginia Modeling & Simulation Center
- Dr. Mark Pullen, George Mason University
- Dr. Randy Shumaker - Director, UCF Institute for Simulation & Training

The MOVES Institute
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Projects

The MOVES Institute
Naval Postgraduate School

3D Visual Simulation & Networked Virtual Environments

In networked virtual environments, we are architecting the technology that allows us to build large-scale, dynamically extensible virtual environments, virtual environments that are semantically interoperable and always on.

The MOVES Institute
Naval Postgraduate School

NPSNET-V
Sponsor – N6M, NRO
PIs – Don Brutzman, Michael Zyda
Goal – Extensible, Scalable Virtual Worlds

Deliverables

Theses: LCDR Ernesto Jose Sallés USN, *A Security System for Runtime-Extensible Virtual Environments;* MAJ William Fischer, USA, *Enhancing Network Communication in NPSNET-V Virtual Environments Using XML-Described Dynamic Behavior (DBP) Protocols;* MAJ David Washington, USA, *Implementation of a Multi-Agent Simulation for the NPSNET-V Virutal Environment Research Project;* LT Michael Wathen, USN, *Dynamic Scalable Network Area of Interest Management for Virtual Worlds*

Papers: Collaborative Virtual Environments 2002, *Security of Runtime Extensible Virtual Environments;* and *A Unified Component Framework for Dynamically Extensible Virtual Environments*

Talks: *SIGGRAPH 2002 Tutorial, Supersize It: Large Scale Graphics and Networking*

Milestones

Re-Architected original system to include XML-described components and kernel structure

Includes HLA networking interoperability, DIS networking interoperability

Released in open source license

Things of Note: Likely to serve as experimental testbed for Extensible Modeling and Simulation Framework (XMSF), which will feature web services-described components

Extensible Modeling and Simulation Framework

XMSF

Collaborators – SAIC, George Mason University

PIs – Don Brutzman & Michael Zyda

Goal – Web-based simulations using XML; simulations created by assembling components described by commercial web-based XML technology

Deliverables

August 2002 XMSF Workshop at NPS: A small collection of top researchers and practitioners in the field that will find consensus on the problems and opportunities in the field of web-based simulation

September 2002 XMSF Symposium at George Mason University: A large collection of the major players in DoD simulation; intended to allow wide review and comment on the white papers generated by the NPS workshop

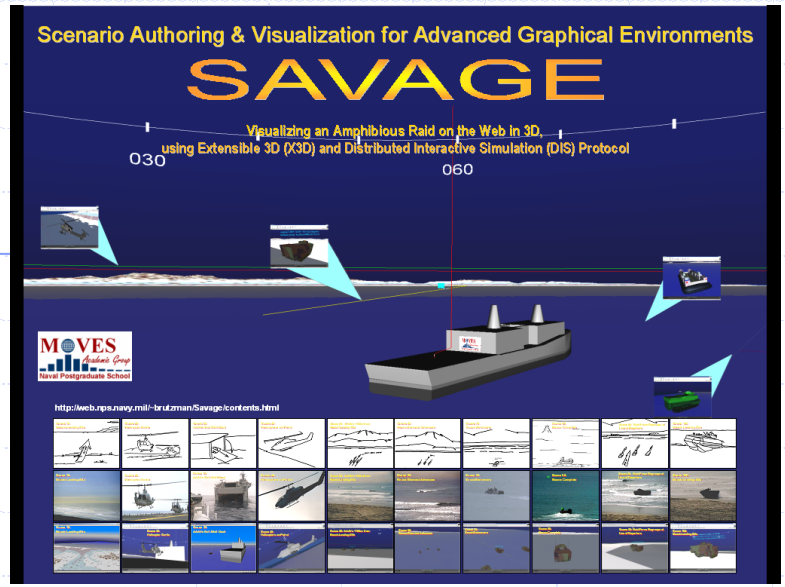
December 2002 Exemplar Applications Small example applications created using web-based simulation technology

Milestones

Workshop organized to coincide with MOVES open house

Symposium organization proceeding

Technology research proceeding



The MOVES Institute
Naval Postgraduate School

Scenario Authoring and Visualization for Advanced Graphical Environments

Sponsor – DMSO

PIs - Curtis Blais and Don Brutzman

Goal - R&D in Web-based, interactive, multi-user 3D environments for training, education, and experimentation.

Deliverables

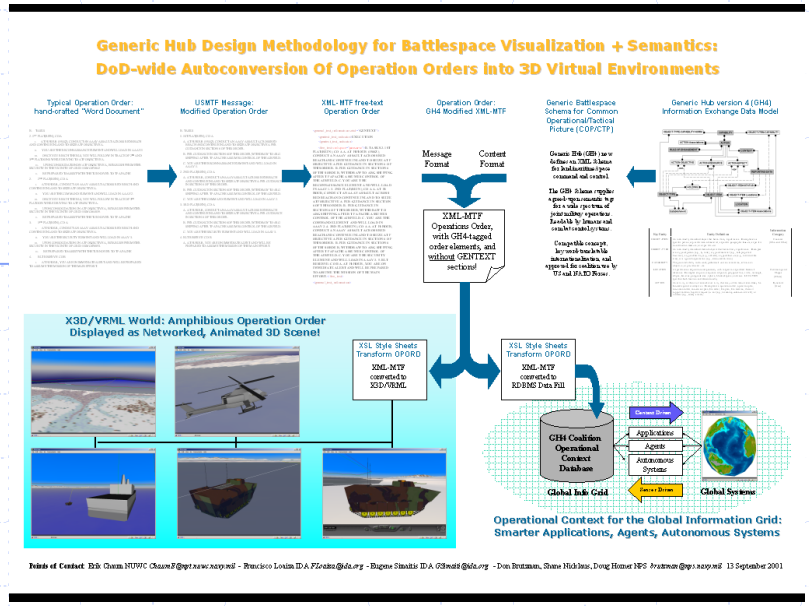
- SAVAGE repository of Web-based 3D models and scenarios (http://web.nps.navy.mil/~brutzman/Savage/contents.html)
- Published paper - Web-Based 3D Technology for Scenario Authoring and Visualization: The SAVAGE Project
- Published paper - Web-Based 3D Reconstruction of Scenarios for Limited Objective Experiments
- Published paper - Emerging Web-Based 3D Graphics for Education and Experimentation
- Monthly progress reports to DMSO

Milestones

- 16 July 2002 - Presentation to Summer Computer Simulation Conference
- 22 July 2002 - X3D Presentation to SIGGRAPH 2002; M5 Release of Open Source X3D Browser
- 23 August 2002 - MOVES Open House presentations
- November 2002 - Presentation to Interservice/Industry Training, Simulation, and Education Conference

Things of Note

- Working with international community to establish the next-generation Web3D standard (X3D).



The MOVES Institute
Naval Postgraduate School

Scenario Authoring and Visualization for Advanced Graphical Environments

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PIs - Curtis Blais and Don Brutzman

Goal - R&D in Web-based, interactive, multi-user 3D environments for training, education, and experimentation.

Faculty/Staff/Contractors

Brutzman, Blais, Weekley, Horner, Locke, Rolands & Associates, Yumetech.

Thesis Titles

LT Michael Hunsberger, USN, June 2001 - 3D Visualization of Tactical Communications for Planning and Operations Using Virtual Reality Modeling Language (VRML) and Extensible 3D (X3D).

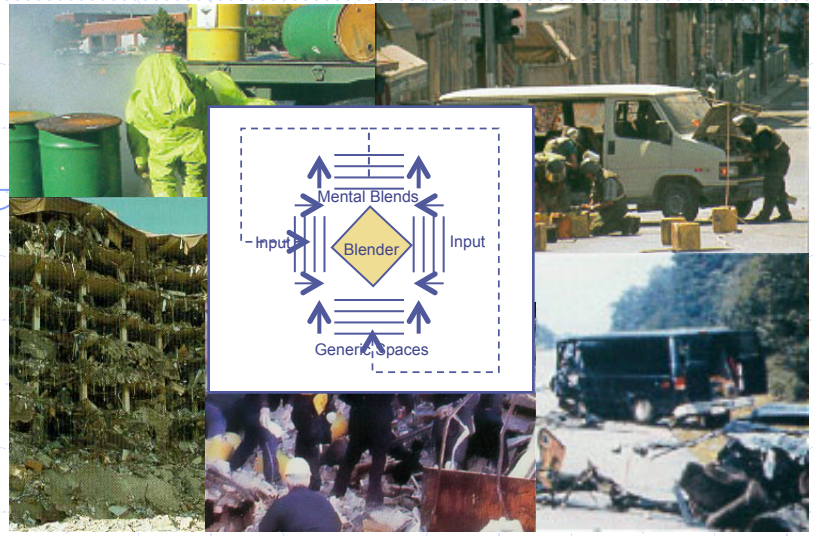
Maj Shane Nicklaus, USMC, June 2001 - Scenario Authoring and Visualization for Advanced Graphical Environments.

LT James Harney, USN, March 2003 – Multi-Agent Simulation for Anti-Terrorism/Force Protection Planning.

Computer Generated Autonomy

In computer-generated autonomy, we are building story engines that allow us to traverse near-infinite collections of story elements in controlled fashion, producing an immersive experience for the user. With a scenario engine, we are determining the space of potential outcomes from a virtual description of an infrastructure, a set of policies, characters and cultural behaviors.

Center for the Study of Potential Outcomes



The MOVES Institute
Naval Postgraduate School

Project IAGO

Sponsor - CDTEMS, N6M

PIs - Ted Lewis, John Hiles & Curt Blais

Goal – Conduct research in multi-agent simulation approaches for modeling of terrorist decision-making and resulting behaviors. Create a foundation for design and conduct of experiments exploring hypotheses regarding vulnerabilities to asymmetric terrorist attacks and possible intervention measures. Create instructional scenarios and simulations for use in the Homeland Security curriculum.

Deliverables

Software design and implementation for creating mental blends based on situation, goals, and subject generic spaces using the Connector-based Multi-Agent System (CMAS) architecture.

Demonstration of model operation and comparison of model outcomes to streams of real-world events, providing foundation for an exploratory laboratory for studying terrorist decision-making processes and resulting patterns of behavior.

Initial codification of real-world terrorist behaviors and personality for simulation application

Prototype server implementation for online collaborative analyses using the software

Milestones

June 2002 - Project Launch

September 2002 – Conceptual model and data collection

October 2002 – Prototype model software design

December 2002 – Demonstration of prototype model

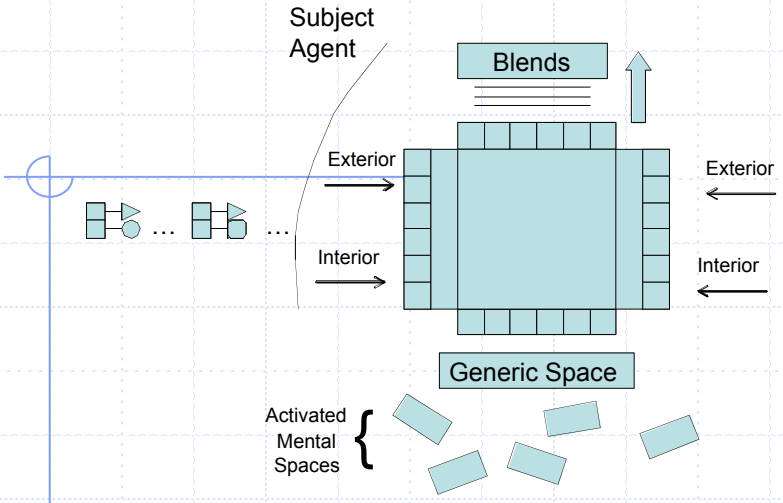
Key Aspects of the Project

Project implements novel modeling approaches based on current cognitive psychology research and cellular biology metaphors, extending Cdr Osborn's Army Game Project Story Engine dissertation research.

Project team includes terrorism subject-matter expert from the Center for Nonproliferation Studies at the Monterey Institute for International Studies.

This is inaugural tasking for the new Center for the Study of Potential Outcomes within the MOVES Institute.

Center for the Study of Potential Outcomes



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Faculty/Staff

John Hiles, MOVES Institute, Technical Director for Computer-Generated Autonomy – Principal Investigator and Chief Architect

Ted Lewis, MOVES Institute, Director of the Center for the Study of Potential Outcomes – Principal Investigator

Chris Darken, MOVES Institute – CMAS analysis

Curtis Blais, MOVES Institute, Research Associate and MOVES Ph.D. student – Software Engineering Manager

Contractors

Gary Ackerman, Monterey Institute for International Studies – Subject Matter Expert

Neil Elzenga, Emergent Designs – Software Engineer

Bruce Allen and Fred Zyda, Digital Consulting Services – Software Engineers

John Mason & Associates – digital artwork

Thesis Titles

CDR Brian Osborn, USN - Interactive Computer Generated Stories, PhD in CS, September 2002.

Maj Joerg Wellbrink, German Army - A Reduced Human Performance Model for Exploring Unintended Consequences and Potential Outcomes, PhD in MOVES, September 2003.

Curtis Blais, NPS Research Faculty - Agent-Based Construction of Large-Scale Virtual Environments, PhD in MOVES, September 2004.

Other Students (thesis topics TBD)

Rob Michael, IS and Zac Staples, NSA (joint thesis)

Tom Orichel, MOVES

Center for the Study of Potential Outcomes

Some press

- LA Times Front Page 2 November 2001
- Fox News 25 November 2001
- Gannett News 5 December 2001
- 16 April 2002 ABC News

November 2, 2001

COLUMN ONE

The Sims Take on Al Qaeda

■ Borrowing from the popular computer game, the new breed of war games might simulate the unpredictable methods of terrorists.

By KAREN KAPLAN, Times Staff Writer

MONTEREY, Calif. -- Inside a concrete-and-glass laboratory at the Naval Postgraduate School, a computer simulation of Osama bin Laden's Al Qaeda terrorist network is beginning to take shape.

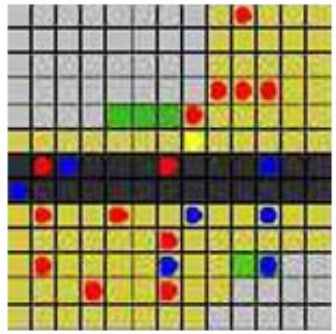
Scientists are preparing to conjure deserts, urban landscapes, communications networks, weapon systems, immigration patterns and an army of terrorists cunning enough to design plots of mass destruction. They also are fashioning millions of potential victims who will be preyed on thousands and thousands of times.

In the new war against terrorism, with its infinite possibilities for unpredictable violence, the military is attempting to understand jihad through the infinitely patient and dogged computer.

"Interesting things happen," said Michael Zyda, who is leading the Navy's simulation project here, "things you didn't expect."

Military strategists have long used computers to wage virtual war, modeling the clash of armies and the devastation of nuclear weapons.

Graphics



Virtual War

Photo Galleries

Afghan "Garbage" Kids

Fox News

Play video

USATODAY.com

Game Zone

12/05/2001 - Updated 04:57 PM ET

Game creators join war against terrorism

By Greg Wright, Gannett News Service

Wanted: Fun-loving, patriotic person willing to create and play video games all day while helping America fight terrorism. Sound like the perfect job? Well, it exists at the Naval Postgraduate School's Modeling, Virtual Environments and Simulation (MOVES) Institute in sunny Monterey, Calif. Twenty-five former commercial video game designers are working with Navy students at the institute to create video game-like simulations to train troops to fight terrorism.

SimCity.com

Some of the training games MOVES creates look similar to Electronic Arts' popular 'SimCity' game.

ABC News

Play Video

Virtual People: Software Agents that Simulate Humans

Sponsor – NPS Research Initiation Program

PIs – Christian Darken

Goal – Situationally-aware language-competent CGF's

Deliverables

White paper on simulating the mind's eye circulated to ONR and DARPA contacts

Additional white papers and demo system under production

Milestones

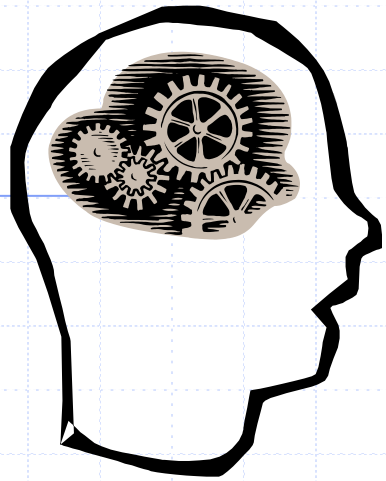
Fall 2001 – Updated artificial intelligence course to include lab based on agents in virtual environments

Winter 2002 – Updated computer animation course to include full coverage of physics-based simulation

Summer 2002 – First course on full-scope high-resolution human behavior modeling (perception/motion/reasoning/ natural language) at NPS

Things of Note

White paper on model-based situation assessment requested from ONR with reference to BAA 02-020 "Affordable Human Behavior Representation"



The MOVES Institute
Naval Postgraduate School

Virtual People: Software Agents the Simulate Humans

Sponsor - NPS Research Initiation Program

PIs – Christian Darken

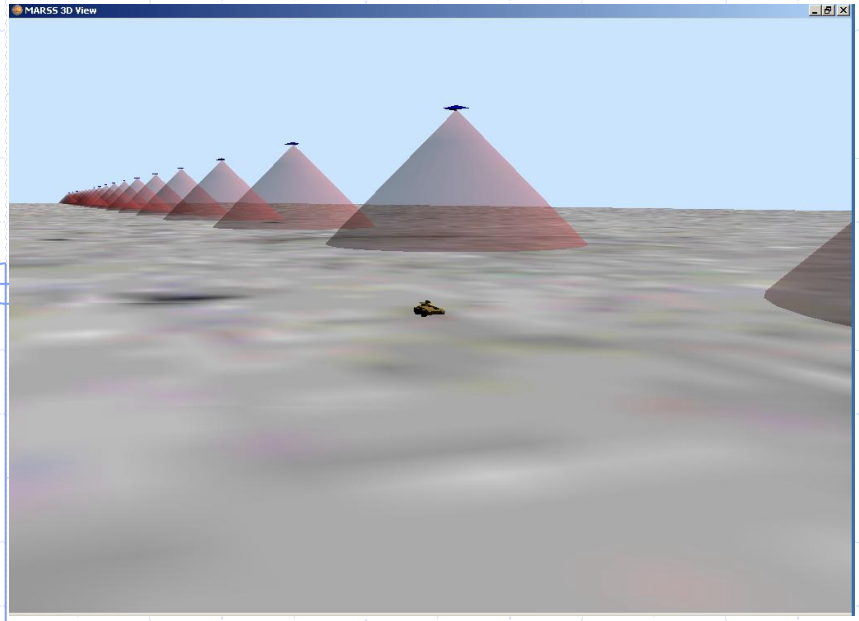
Goal - Situationally-aware language-competent CGF's

Faculty/Staff/Contractors

C. Darken

Thesis Titles

LTC Rene' Burgess, USA - Intelligent Battle Analysis to Reduce Simulation Overhead Requirements, June 2003 (prospective)



The MOVES Institute
Naval Postgraduate School

Analytical Decision-Supporting Research Using Synthesized Adaptive Agent Based Modeling and Mathematical Modeling

Sponsor – CNO N6M

PIs – Donald Gaver, John Hiles & Patricia Jacobs

Goal - R&D in support of Navy and Joint Decision making

Publications

T. Barkdoll, D. Gaver, K. Glazebrook, P. Jacobs, S. Posadas, "Suppression of enemy air defenses (SEAD) as an information duel," accepted for publication in *Naval Research Logistics*.

S. Andrade, N. Rowe, D. Gaver, and P. Jacobs, "Analysis of shipboard firefighting-team efficiency using intelligent agent simulation," Proceedings of the 2002 Command and Control Research Technology Symposium, Naval Postgraduate School, Monterey, CA, June 11-13, 2002.

D. Gaver, K. Glazebrook, and P. Jacobs, "Military stochastic scheduling treated as a multi-armed bandit problem," Naval Postgraduate School Technical Report, NPS-OR-01-010.

Faculty and Officer-Student Collaborators

Professor Kevin Glazebrook, University of Edinburgh

Professor Neil Rowe, MOVES and Computer Science

Professor Steven Pilnick, OR Dept. & Meyer Institute

LT Timothy Barkdoll, USN

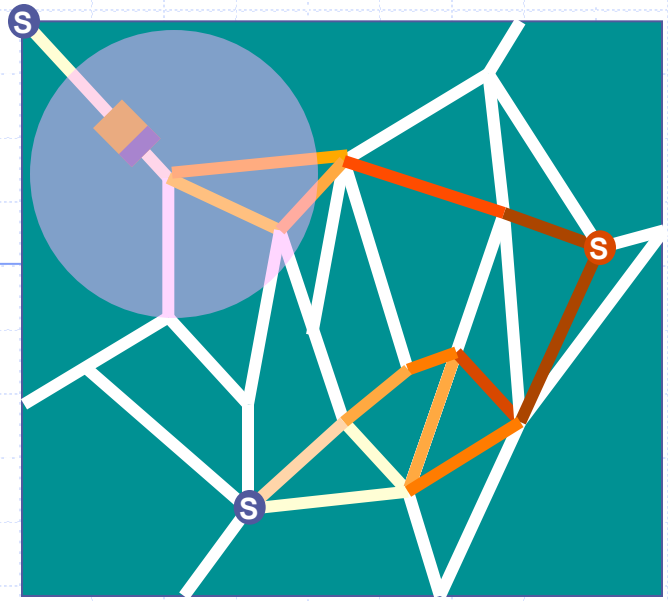
MAJ Sergio Posadas, USMC

CPT Alistair Dickie, Australian Army

LT Sylvio Andrade, Brazilian Navy

Thesis Title

CPT Alistair Dickie, Australian Army – Multi Agent Robot Swarm Simulation, MS in Operations Research in cooperation with the MOVES Institute, June 2002.



The MOVES Institute
Naval Postgraduate School

Adaptive Rules In Emergent Logistics (ARIEL)

Sponsor – Joint Warfare Analysis Center (JWAC)

PIs – John Hiles & Peter Purdue

Goal – Examine the feasibility of agent-based technology to study the movement of material through a road network after disruptions occurred.

Deliverables

Build a software system that uses agent-based technology to move trucks carrying relief supplies through a road network.

It allows to manually introduce infrastructure disruptions (eg. blocked roads) and examine the impact of those disruptions and the reaction of the autonomous truck-driver agents.

The software must produce an ESRI Arcview SHAPE file output.

Milestones

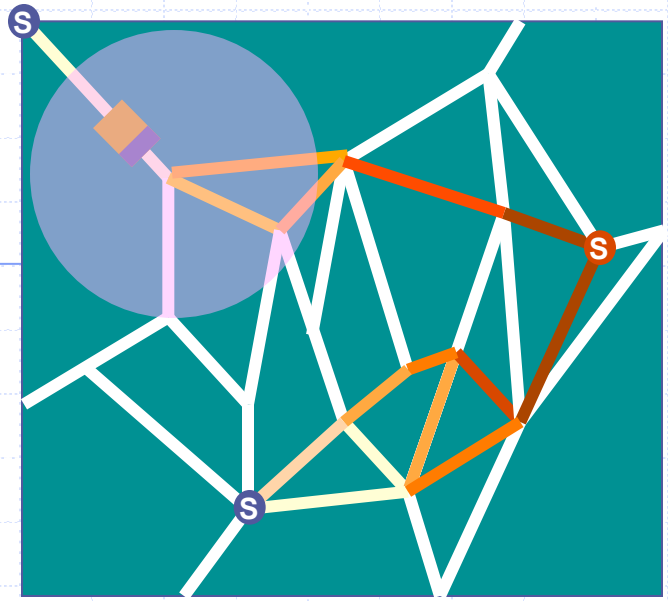
08 July 2002 – project starts

each month – report on the project status (JWAC)

31 Jan 2003 – software delivery

Things of Note

This project could be a basis for a follow on project which explores ways to effectively disrupt a delivery system, and builds a system which let autonomous distruction agents introduce disruptions.



The MOVES Institute
Naval Postgraduate School

Adaptive Rules In Emergent Logistics (ARIEL)

Sponsor – Joint Warfare Analysis Center (JWAC)

PIs – John Hiles & Peter Purdue

Goal – Examine the feasibility of agent-based technology to study the movement of material through a road network after disruptions occurred.

Faculty/Staff/Contractors

John Hiles (Moves Staff)

Thomas Orichel (Student)

Paul Schneider (JWAC)

Thesis Titles

CPT Thomas Orichel, German Army – Adaptive Rules In Emergent Logistics (ARIEL)

The MOVES Institute
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Human Performance Engineering

In human performance engineering, the work is to build deployable simulators for the Navy & Marines Corps and evaluate their utility for training.

The MOVES Institute
Naval Postgraduate School

Virtual Technologies and Environments (VIRTE)
Sponsor - ONR 342
PIs - Rudy Darken, CDR Joe Sullivan, LCDR Russ Shilling
Goal - Deployable Training for Navy and Marine Corps

Deliverables

ChrAVE – (Chroma-Keyed Augmented Virtual Environment) Imbedded trainer/flight rehearsal tool designed to practice and maintain pilot and navigation skills while on deployment.

Artillery Forward Observer (FO) Trainer/Simulator – Designed to maintain FO skills while on deployment.

-Runs on a PC in a distributed network

Close Quarter Battle (CQB) Trainer/Simulator – Allows users to rehearse building clearing drills while on deployment via Head Mounted Display and a tracked weapon in a networked virtual environment.

Milestones

Spring 2002. First prototype VE helicopter simulator completed

Summer 2002. Full cognitive task analysis of close-quarters combat completed

Summer 2002. HLA module completed

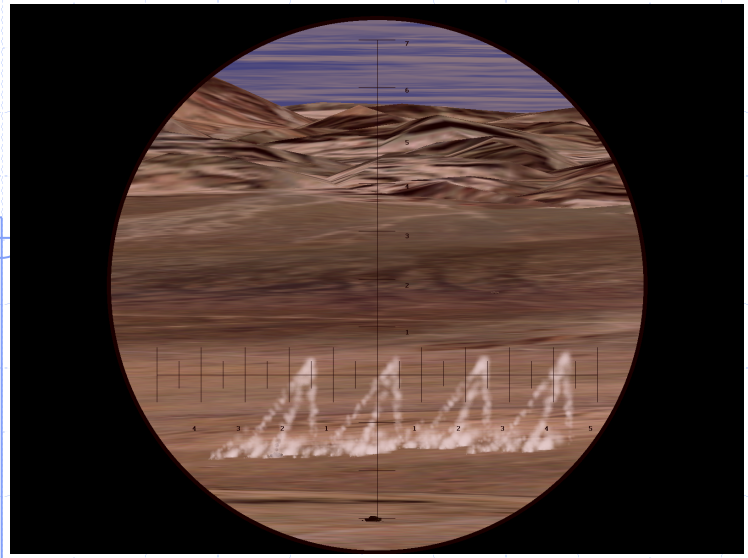
Fall 2002. HLA integration completed, JSAF compliant

Fall 2002. First combined arms tasks supported.

Spring 2003. Field testing with Marine Corps squadron.

Spring 2003. Field testing with CAX at 29 Palms

Summer 2003. Integration with other VIRTE simulators (AAAV & LCAC)



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Virtual Technologies and Environments (VIRTE)
Sponsor - ONR 342
PIs - Rudy Darken, CDR Joe Sullivan, LCDR Russ Shilling
Goal - Deployable Training for Navy and Marine Corps

Faculty/Staff/Contractors

- Rudy Darken
- CDR Joe Sullivan
- LCDR Russ Shilling
- Erik Johnson
- Matt Prichard
- John Locke

Theses

- Lennerton, M. 2002 *Exploring a Chromakeyed Augmented virtual Environment for Viability as an Embedded Training system for Military Helicopter Pilots*
- Brannon, D. & Villandre, M. 2002 *A Forward Observer PC Simulator*
- Aronson, W. 2002 *A Cognitive Task Analysis of Close Quarters Combat*
- Reece, J. 2002 *Virtual Close Quarter Battle Graphical Decision Trainer*
- List, R. 2002 *A Rendering System Independent HLA Implementation for Military Simulations*
- Unguder, E. 2001 *The Effects of Natural Locomotion on Maneuvering Task Performance in Virtual and Real Environments*
- Norlander, K. 2001 *Emergent Leadership on Collaborative Tasks in Distributed Virtual Environments*
- Boswell, J. 2001 *User-Centered Iterative Design of a Collaborative Virtual Environment*
- Karahan, B. 2000 *Comparison of Performance Measures in the Virtual Environment and Real World Land Navigation Tasks*
- Stine, J. 2000 *Representing Tactical Land Navigation Expertise*
- Wright, G.T. 2000 *Helicopter Urban Navigation Training Using Virtual Environments*
- McLean, T. 1999 *An Interactive Virtual Environment for Training Map-Reading Skill in Helicopter Pilots*

Context Machine

Sponsor – DARPA IPTO

PIs – Perry McDowell & Michael Zyda

Goal – Develop the fundamental design for implementing the context machine.

Deliverables

- Simulated wearable system for future soldiers running on the *America's Army: Operations* engine
- Develop an engine that determines context from simple sensor-abstraction inputs.
- Develop an engine that provides a course-of-action for the bearer of the context machine.
- Demonstrate the effectiveness of the context machine.

Milestones

05 December 2001 - demo initial Context Machine at the DARPA IPTO Augmented Cognition Workshop in Austin, Texas showing:

- Context sensitive path planning
- Highlighting of important yet easy to miss info
- Visual representation of system's mental model
- Simulated augmented reality device

10 July 2002 – demo advanced version at the DARPA IPTO Augmented Cognition Workshop in Dulles, VA showing:

- New architecture, including a binding layer
- Modified methods to present information

The Context Machine

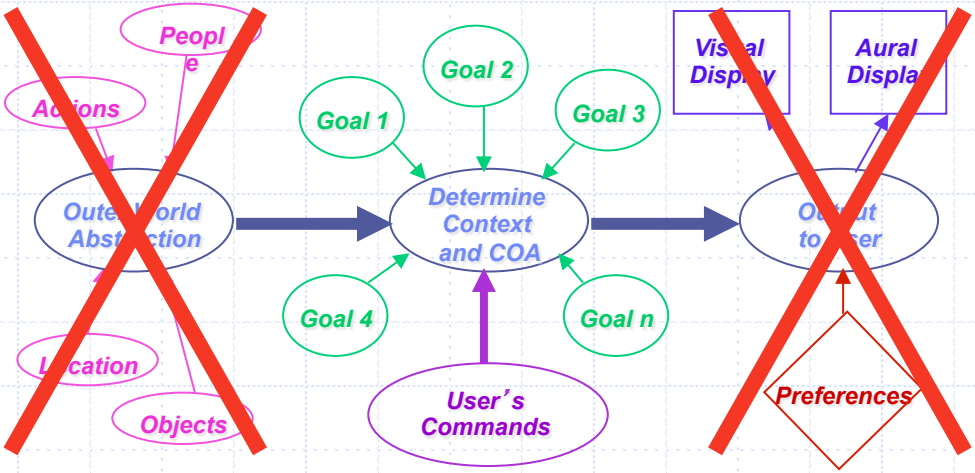
Sponsor – DARPA IPTO

PIs – Perry McDowell & Michael Zyda

Goal – Develop the fundamental design for implementing the context machine, a machine that determines the "context" for the individual that possesses the machine & provides advice/ guidance to the bearer.

Faculty/Staff/Contractors

McDowell, Kapolka, Zyda.



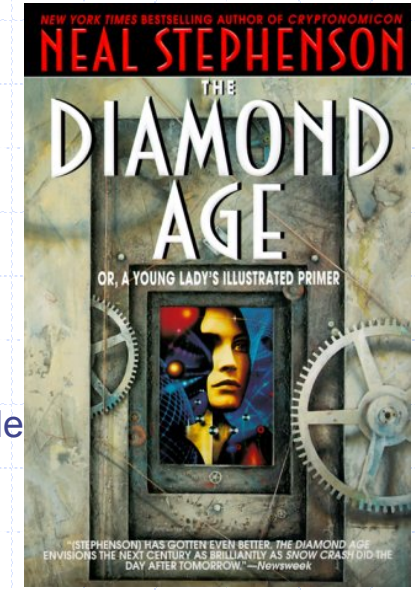
Thesis Titles

Perry McDowell, PhD student in Computer Science, The Context Machine

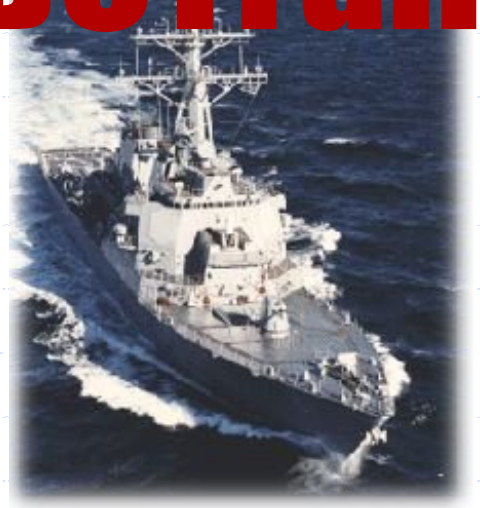
Sci-Fi Inspiration

The Diamond Age, by Neal Stephenson

Futuristic novel of a young girl who discovers an interactive book which plays scenes demonstrating proper behavior of a young lady. She is able to drastically change her life by adhering to lessons learned in the book.



DCTrain



The MOVES Institute
Naval Postgraduate School

Evaluation of DCTrain

Sponsor – University of Illinois at Urbana/Champaign & ONR

PI – Perry McDowell

Goal – Measure Effectiveness of a Computerized DCA Trainer

Deliverables

Create a testing plan to measure the effectiveness of DCTrain, a computerized trainer for DCA's both in the schoolhouse and in the fleet. DCTrain simulates DC Central for a DDG-51 class ship during a wide range of casualties

Create realistic and compelling scenarios which will produce concrete results documenting the effectiveness of DCTrain

Measure the improvement in DC Knowledge of SWO students at NPS who use the system

Consider ways to improve the system

Milestones

03 July 2002 – got DCTrain running at NPS

12 July 2002 – commenced class to prepare experimenters to create scenarios and run experiments

06 August 2002 – commence testing on SWO's at NPS

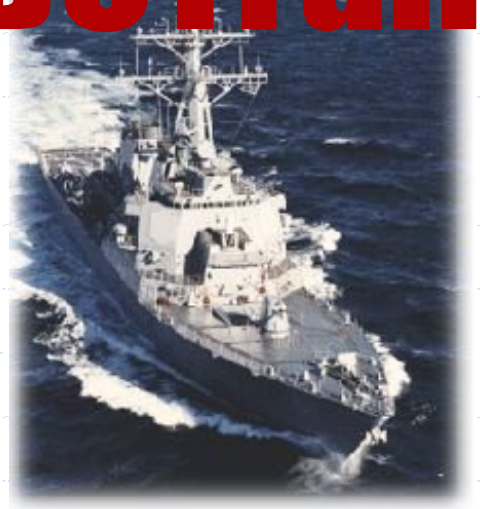
20 September 2002 – complete testing and data evaluation

01 October 2002 – commence theses to improve DCTrain

Things of Note

Applying for additional funding from N6M to improve and expand DCTrain at NPS

DCTrain



The MOVES Institute
Naval Postgraduate School

Evaluation of DCTrain

Sponsor – University of Illinois at Urbana/Champaign & ONR

PI – Perry McDowell

Goal – Measure Effectiveness of a Computerized DCA Trainer

Faculty/Staff/Contractors

McDowell.

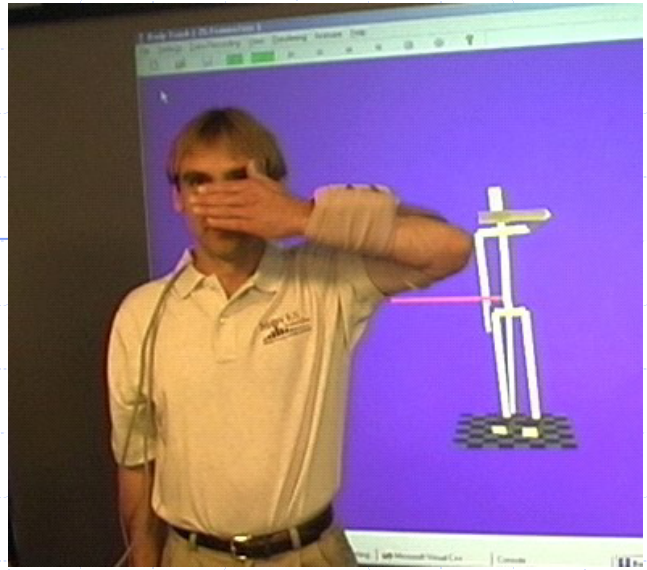
Thesis Titles

None to Date

Students involved in this are enrolled in a special topics class, MV-4920.

Immersive Technologies

In immersive technologies, we have designed a source-less tracker that can be manufactured wrist-watch size, and have performed considerable work on the deployment of sound to enhance the feeling of immersion.



The MOVES Institute
Naval Postgraduate School

Inertial/Magnetic Posture Tracking

Sponsor - N6M ARO

PIs – Eric Bachmann, Xiaoping Yun & Robert McGhee

Goal - Create a new technology for human body motion tracking in networked virtual environment applications.

Deliverables

Novel hybrid inertial and magnetic sensor called MARG (Magnetic, Angular Rate, and Gravity). Operation does not depend on any signal source. It is readily operable anywhere without abnormal amount of magnetic interference.

Complimentary quaternion-based filter developed to estimate the orientation of a rigid body. Quaternions are used to avoid singularity in orientation representation. Able to continuously correct for drift without the need for still periods.

Simple and efficient calibration algorithms for the sensor components and sensor attachment.

Realistic human avatar based on laser scan data.

Milestones

October 2001 - Second generation MARG sensor (MARG II) designed, built and tested. Measures 8.4x4.2x2.9 cm, a 26% reduction in volume over previous generation. Integrated capacitor coupling circuit for angular rate sensor drift correction.

May 2002 – Improved quaternion filter algorithm implemented and tested in real-time system. Accuracy and dynamic response equal to previous versions with an order of magnitude reduction in complexity

The MOVES Institute
Naval Postgraduate School

Inertial/Magnetic Posture Tracking

Sponsor - N6M ARO

PIs – Eric Bachmann, Xiaoping Yun & Robert McGhee

Goal - Create a new technology for human body motion tracking in networked virtual environment applications.

Faculty/Staff/Contractors

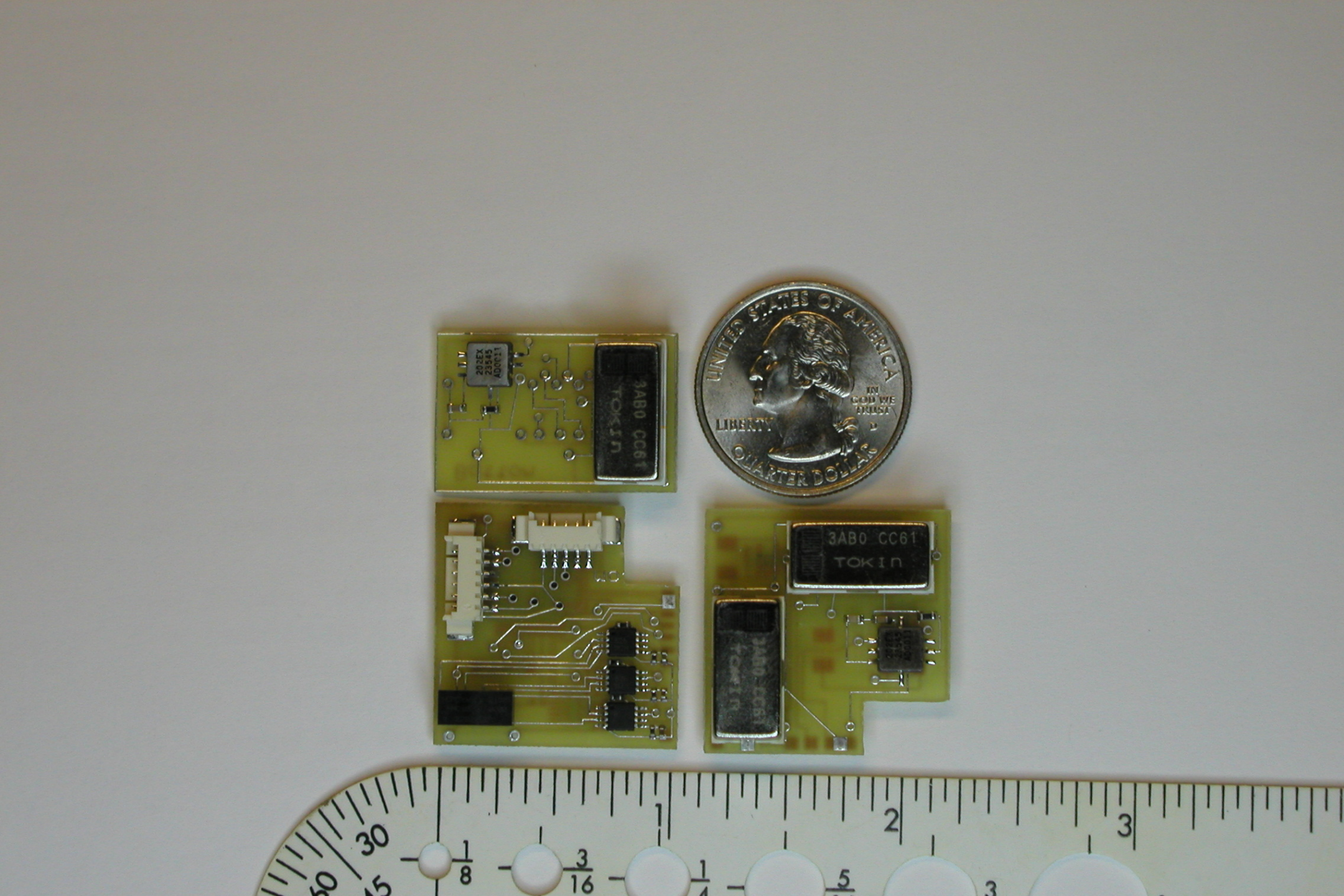
Bachmann, McGhee, McKinney, Yun, Zyda.

Thesis Titles

Alper Sinav, "Analysis and Modeling of the Virtual Human Interface for the MARG Body Tracking System Using Quaternions" MS Thesis in Modeling, Virtual Environments, and Simulation (MOVES), March 2002.

James Allen Dutton, "Developing Articulated Human Models from Laser Scan Data for Use as Avatar in Real-time Networked Virtual Environments," MS Thesis in Modeling, Virtual Environments, and Simulation (MOVES), September 2001.

Pierre G. Hollis, "An Improved Magnetic, Angular Rate, Gravity (MARG) Body Tracking System," Engineer Degree Thesis in Electrical Engineering, June 2001.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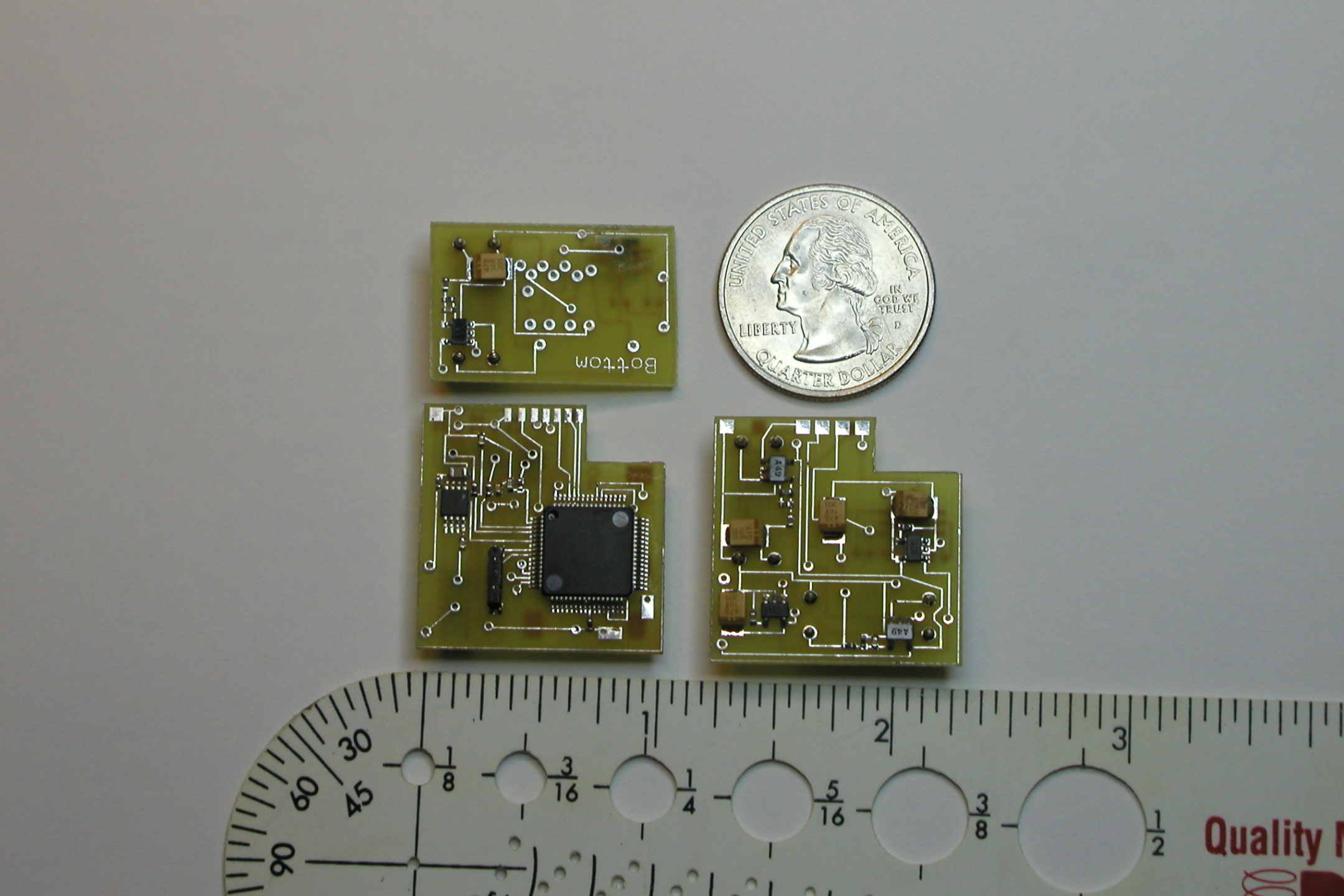
TOKIN
UNITED STATES OF AMERICA
LIBERTY
IN GOD WE TRUST
QUARTER DOLLAR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Quality

The MOVES Institute
Naval Postgraduate School

Overall Immersive Audio Program
Project: ONR
PI: LCDR Russell Shilling, Ph.D.

Graduate Students:

LT Hsin-Fu Wu, USN	OR
Maj Tom Greenwald, USA	MOVES
LT Stephen Ulate, USN	MOVES
Capt Sam Mowrey, USMC	OR
CDR Eric Krebs, USN	MOVES

Recently Graduated:

LT James Campbell, USN	OR	Spring '02
Capt Rick Sanders, USA	MOVES	Spring '02
LT Mark Scorgie, USN	MOVES	Winter '02

Summary of Goals:

Research focuses on the use of immersive audio technologies to improve training performance in simulation, radio communications, data mining techniques, radar, sonar, air traffic control, and UAV operations. Research is combining headphone-based spatialization techniques with speaker-based techniques and has been heavily collaborating with the entertainment industry, including Lucasfilm Skywalker Sound, Lucasfilm THX, Dolby, Creative Labs, etc. Funding is provided by three different ONR units ($100k).

The MOVES Institute
Naval Postgraduate School

Applying Entertainment Audio Techniques to VE

Project: ONR VIRTE

PI: LCDR Russell Shilling, Ph.D.

Deliverables:

- Compare emotional impact of different audio technologies using objective measures (physiology)
- Record professional quality sound effects for LCAC, AAAV, and V-22
- Adapt entertainment industry techniques for putting audio in movies to VE and videogames
- Determine what sounds need to be included in a training scenario, MOUT in particular.
- Learn from industry leaders in the area: Dolby, THX, Skywalker Sound, etc.
- Propose and auditory architecture that is affordable and meets the complex needs of the project.

Milestones

February 2002 : LCAC Recorded with help of Lucasfilm Skywalker Sound. Sound also used in movie, "Minority Report".

May – Sept 2002: Four theses completed

May 2002: Working Audio Architecture Proposed

May 2002: Game Design for America's Army Dolby Digital certified and game audio introduced to public and reviewers.

August 2002: AAAV Recording

Things of Note

Article coming up in Game Developers Magazine

Lessons on Audio Design by Gary Rydstrom (multiple Academy Awards in Sound Design)

The MOVES Institute
Naval Postgraduate School

Advanced Spatialized Auditory Display Research

Sponsor - ONR

PI – LCDR Russell Shilling, Ph.D.

Goal – Develop and design spatialized advanced auditory displays for improving performance in radar, sonar, and radio communications

Deliverables:

- Methods for sonification of hyper-dimensional data sets for improved data mining techniques
- Techniques for improving perception in multi-channel radio communications tasks
- Improve Air-Traffic Control and UAV operations using advanced spatialized auditory displays
- Comparisons of headphone and speaker systems
- Develop ways of measuring sound localization ability to improve the design of future spatialized auditory displays over headphones

Milestones:

- May 2002: Radio communications thesis study finished finding much improved performance for comprehending four simultaneous radio channels.
- July 2002: Localization task to be completed using HMD and inertial headtracker
- September 2002: Sonification and ATC theses to be completed.

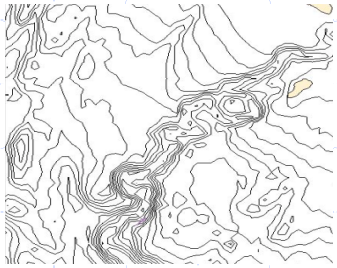
Things of Note

- Three OR Students and Two MOVES Students contributed to this effort
- One of the best headphone audio labs around!
- $70k Funding (combining two ONR efforts)

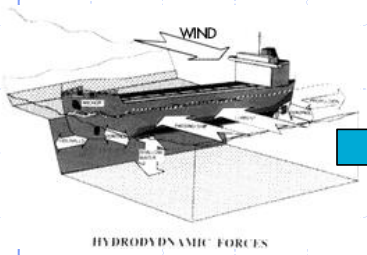
The MOVES Institute
Naval Postgraduate School

Evolving Operational Modeling

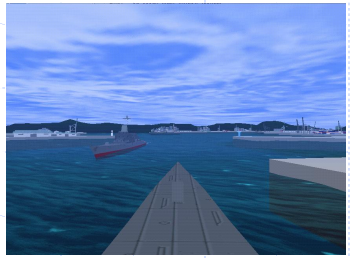
In evolving operational modeling, we are creating a synthetic ocean environment for exploring littoral conflict, performing R&D in support of ForceNet, & managing all future development of the Navy Simulation System.



GIS Chart



Ship Hydro-Dynamical Model



3D Simulation

The MOVES Institute
Naval Postgraduate School

Navy Synthetic Ocean Project
Sponsor – CNO-N6M
PIs – Peter C Chu
Goal - R&D in support of Naval Littoral Warfare Simulations.

Deliverables

(1) ArcView GIS system has been implemented into the MOVES Institute computer system.

(2) One chapter with lab entitled “GIS for Modeling and Simulation” was developed for the course: MV4030 Modeling and Simulation in Ocean Environment.

(3) The Navy’s Global Bathymetry Data Set (unclassified at 1’ X 1’ resolution) has been implemented into the ArcView GIS.

(4) The Navy’s Global Digital Environmental Model (GDEM) with three dimensional climatological temperature, salinity, and sound speed data has been implemented into the ArcView GIS.

(5) The Navy’s Modular Ocean Data Assimilation System (MODAS) with capability of processing real-time three dimensional METOC data.

Milestones

1 March 2002 – Establishment of synthetic ocean using GIS

2 July 2002 – Establishment of ship hydro-dynamical model Internet

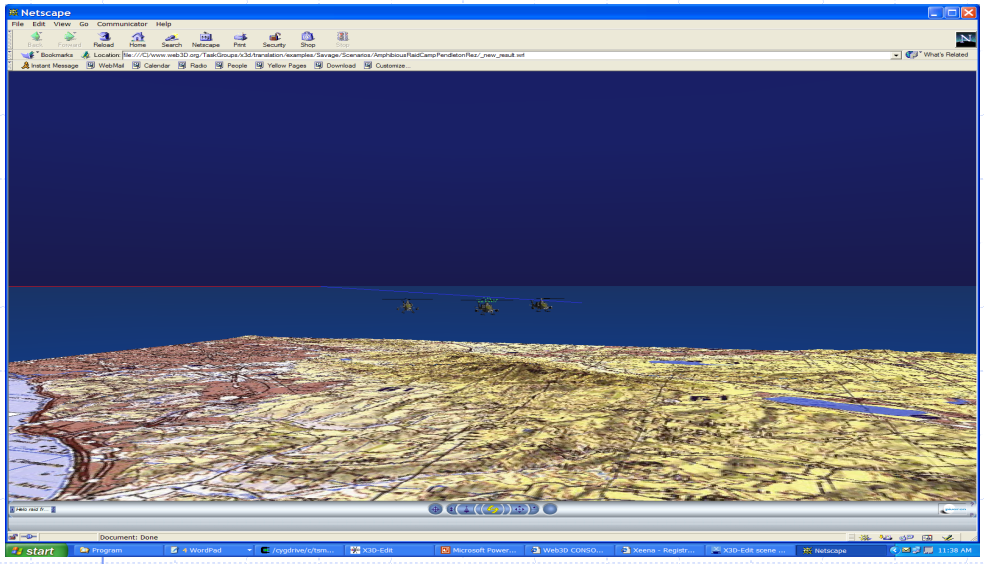
20 August 2002 – Demo on harbor simulation (MOVES Open House)

1 October 2002 - additional mission packs & continued R&D.

Things of Note

Press in over 20 news publications

Two UW students completed their theses in June



The MOVES Institute
Naval Postgraduate School

Expeditionary Sensor Grid (ESG) Enabling Experiments (EEE) FY-03
Sponsor – ONR, NWDC
PIs – Doug Horner, Alex Callahan
Goal - R&D in support of FORCEnet.

Description:

•ArchAngel is a prototype combining the W3C Semantic Web recommendations with software agents to facilitate military Command and Control.

Background

•EEE is looking at distributed computing and the application of software agents to manage a future littoral battlespace with 10Ks to 100Ks of sensors.

Deliverables

- ArchAngel software
- Documentation to support the software.
- Final report on Semantic Web integration into EEE.

Milestones

October 2001 – NWDC initiates Anti-Terrorism Force Protection effort to improve maritime harbor coordination.

March 2002 – Delivery of ATFP C2 Prototype.

April 2002 – EEE effort underway.

July 2002 – EEE involvement with FBE JULIET.

August 2002 – Experimentation Scheduled

October 2002 – Delivery of final report

Things of Note:

Joint, multi-lab participation - NWDC, NPS, SSC, AFRL, NUWC, NAVAIR

Development of a agent-based, distributed computing architecture to support a proliferation of sensors.

NPS leads the Semantic Web working group within effort.

Three NPS students and three faculty involved.

The MOVES Institute
Naval Postgraduate School

Expeditionary Sensor Grid (ESG) Enabling Experiments (EEE) FY-02

Sponsor – ONR, NWDC

PIs – Doug Horner, Alex Callahan

Goal - R&D in support of FORCEnet concepts.

Faculty/Staff/Contractors

Doug Horner, Alex Callahan, Curt Blais, Chris Darken, John Hiles.

Thesis Titles

Agent Proxies and Semantic Context in the Operational Continuum by Marty Hagenston Sam Chance, Clyde Richards .

The MOVES Institute
Naval Postgraduate School

Navy Simulation System Program Management

Sponsor – N60M

PIs – Alex Callahan

Goal – Organize, Control and Direct the Naval Simulation System. Provide configuration control, provide distribution of software and documentation and coordinate user support.

Faculty/Staff/Contractors

Callahan, Buss, Blais, Horner, VanHise, Falby, METRON, and Rolands and Associates

Things of note

1 OCT 2002 – Project Start. This is an ongoing project that will be funded annually

NSS course syllabus is complete. Courseware to be completed this quarter. Course to be taught next quarter.

Three students developing thesis proposals on research to extend the capabilities of the model using xml and agents.

The MOVES Institute
Naval Postgraduate School

Defense & Entertainment Collaboration

In defense/entertainment collaboration, we have Transformed Army recruiting by constructing a suite of PC games that provide the experience of a potential career in the Army and researching the ability for computing player aptitude from game play. We have fielded the largest played networked PC game in history from inside of our institute, a game that has been the recipient of several “best game” or “runner up for best game” of the year awards.

The MOVES Institute
Naval Postgraduate School

Army Game Project
Sponsor - ASA M&RA
PIs - Michael Zyda, John Hiles & Russ Shilling
Goal - **Transform** US Army recruiting.
R&D in support of Army strategic communication.

Deliverables

- Americas Army Operations - networked 3D game that allows the exploration of a potential career as an infantryman in the US Army
- Americas Army Soldiers - story-based game that allows the exploration of additional MOSs in the Army
- Interactive story engine - connector-based multi-agent system that supports directed exploration of an infinite story space.
- Technology for measuring the ASVAB score from videogame play.
- Large-scale game networking - server farm & web site AmericasArmy.com

Milestones

- 22 May 2002 - demo & announce both games at Electronics Entertainment Expo
- 4 July 2002 - Recon version of Operations to Internet
- 26 August 2002 - post Operations gold master to Internet
- 1 October 2002 - additional mission packs & continued R&D.

Things of Note

- Press in over 70 news publications at E3 launch & since.
- 28% of all hits on Goarmy.com are from AmericasArmy.com
- 3,500,000 downloads so far, double the previous rate record of any Internet-posted game.
- 900,000+ players registered.

The MOVES Institute
Naval Postgraduate School

Army Game Project
Sponsor - ASA M&RA
PIs - Michael Zyda, John Hiles & Russ Shilling
Goal - **Transform** US Army recruiting.
R&D in support of Army strategic communication.

Faculty/Staff/Contractors

Zyda, Hiles, Mayberry, Falby, Shilling, Juntiff, Minns, Ball, Buhl, Chang, Chang, Champlin, Brown, Hiles, Ahearn, Ahearn, Davis, Robaszewski, Bailey, Jones, Dossett, Superville, Olson, Bossant, Wiglesworth, Elzenga, Mason.

Thesis Titles

LT Dave Back, USN - Agent Based Soldier Behavior in Dynamic 3D Virtual Environments, MS in MOVES, March 2002.

Christian Buhl – Coordinated Agent Based Soldier Behaviors, MS in MOVES, exp. 2003.

LT Jeffrey DeBrine and LT Donald Morrow, USN – Repurposing Commercial Entertainment Software for Military Use, MS in MOVES, Sep 2001

Thesis Titles (cont'd)

MAJ Thomas Greenwald, USA - Immersive Sound - AGP Close Quarters Combat, MS in MOVES, exp. Sep 2002

Maj Keith Perkins, USA - AGP Helicopter Physics & Real-Time Path Generation, MS in MOVES, September 2002?

LT Victor Spears, USN - Terrain Level of Detail in First-Person, Ground-Perspective Simulation, MS in MOVES, March 2002.

CDR Brian Osborn, USN - Interactive Computer Generated Stories, PhD in CS, September 2002.

E3 - 22 May 2002

E3 Booth

Our booth at E3 had giant display screens high above the convention floor.

Every two hours an Army bugler called in an armed company of men simulating an air insertion, including soldiers scrambling down ropes hung from the ceiling of the Los Angeles Convention Center.

The long lines to our booth unfortunately blocked our Sony Playstation 2 neighbors next door (thankfully their head of security was retired Army).


AGE of MYTHOLOGY
Microsoft game studios
ENSEMBLE STUDIOS
ELECTRONIC ENTERTAINMENT EXPO
id sa
Interactive Digital Software Association
SEE THE OFFICIAL U.S. ARMY GAME
AMERICA'S ARMY
WEST HALL
BOOTH 2350
ATARI
Interactive Digital Software Association


THE OFFICIAL U.S. ARMY


AMERICA'S
ARMY
GAME
ARMY


ARMY
DEFEND FREEDOM


THE OFFICIAL U.S. ARMY GAME
AMERICA'S ARMY
EMPOWER YOURSELF DEFEND FREEDOM
ARMY


OFFICIAL U.S. ARMY GAME
ERICA'S ARMY
ER YOURSELF DEFEND FREEDOM
Intel Analyst
96-B
AME CA'S
ARMY
SM
GROVE
manlift
STAR VIDEO


THE OFFICIAL U.S.ARMY GAME
AMERICA'S ARMY
EMPOWER YOURSELF DEFEND FREEDOM
MOVES
Institute
e School


AMERICA'S ARMY
ARMY GAME


AMERICA'S
ARMY
ARMY
DEFEND FREEDOM


THE OFFICIAL


AMERICA'S
POWER YOURSELF


ERICA'S ARMY
THE OFFICIAL U.S.

E3 Video

Play video

AmericasArmy.com

The MOVES Institute
Naval Postgraduate School

22 May 2002 Wednesday

- 180,000 unique visitors/hour
- 18,000 pages served every 5 seconds

Just to see images from the game (not on the Net until 4 July 2002).

May 22, 2002

Talk about it | E-mail story | Print

MOVES Institute
Graduate School

Army's New Message to Young Recruits: Uncle 'Sim' Wants You

■ Technology: The service has created video games to woo a media-savvy generation with a simulation of military life.

By ALEX PHAM, Times Staff Writer

America's youth would rather play video games than do push-ups in the mud--a reality the U.S. Army wants to harness to its advantage.

Eager to prove it's not your grandfather's military, the Army is developing video games to recruit and build awareness among Generation Y.

Today at the Electronic Entertainment Expo in Los Angeles, the Army will unveil two games designed to appeal to a media-saturated, tech-bombarded generation. One is a sanitized version

Photo Gallery

The Army's Video Game

Times Headlines

Bonanza for Art of the West

INS Error Cited on Atta's Visa

FBI Expects Suicide Bomb Attack in U.S.

'Gangs' Acts Locally but Thinks Globally

Guardsman Mostly Kept Danger to Himself

more >

AGP Awards

- Frictionless Insight, E3 Awards, "Best Business Model (Developer)," 5/27/02
- Gamespy, Runner Up, Best PC Action Game
- IGN, Biggest Surprise, 5/29/02
- Wargamers, Best of Show, First-Person/ Tactical Shooters, 6/4/02
- Well-Rounded Entertainment, "Best of E3 2002," 6/01/02

AGP
- Reviews & Previews

Frictionless Insight, game review editors, "America's Army, the Official U.S. Army Game," 5/27/02

Gamesdomain, "America's Army: Preview," by Richard Greenhill, 6/2/02

Mygamer.com, "The US Army likes Unreal," game review editors, 5/21/02

CNET Reviews, "Virtual metal jacket, "by Darren Gladstone, senior editor, 6/14/02

GamesFirst!, "Preview, America's Army," by Paul Cockeram, 6/8/02

IGN.COM, ""America's Army:' The Army's making a game of its own now", 5/30/02

Gamespot PC, "America's Army: Operations," by Amer Ajami, 7/02/02

Zengamer, "America's Army: Operations" by Marcin Manek, 7/6/02

AGP Articles

Adrenaline Vault, "U.S. Army Introduces America's Army," by David Laprad, 5/22/02

Blue's News, "U.S Army Licenses Epic Games' Unreal Engine for PC Game," 5/21/02

BusinessWeek Online, "The Army's New Killer App," by Arlene Weintraub, 5/22/02

Christian Science Monitor, Video game offers young recruits a peek at military life, by Gloria Goodale, 5/31/02

CNN, "Army is looking for a few good gamers," by Renay San Miguel, 5/22/02

CNNMoney, Your tax dollars at play, by Chris Morris, 6/3/02

CNET, "U.S. Army invades game business," by David Becker, 5/22/02

Dolby, press release, " Dolby Lends Expertise to Sound Design Team for America's Army: Operations, Combining Realism and Emotion," 7/1/02

AGP Articles

Gamespy, "Uncle Sam wants you … to play games," by Sal "Sluggo" Accardo, 5/27/02

HomeLan Fed, "America's Army: Operations Interview," by John Callaham, 5/22/02

LA Times, "Army's New Message to Young Recruits: Uncle 'Sim' Wants You," by Alex Pham, 5/22/02

LANparty.com, gaming editor's review, "America's Army: Operations," 5/23/02

Monterey Herald, "NPS-spawned war games catching on big," by Kevin Howe, 7/23/02

MSNBC, "Video Game Used To Recruit For Armed Forces, " 5/22/02

Newsweek, "Full Metal Joystick," by Trent Gegax 14 Oct 2002

Reuters, "Army Turns to Computer Games to Woo Recruits," by Franklin Paul, 5/23/02

Salon, "Weapons of Mass Distraction," by James Au, 4 Oct 2002

San Francisco Chronicle, "Adopting the latest thing in advertising, Army out to do some computer recruiting," by Carrie Kirby, 8/5/02

AGP Articles

San Jose Mercury News, "U.S. Army invades video game territory," by Anthony Breznican, 5/23/02

US Army, press release, "U.S. Army Introduces 'America's Army" PC Game," 5/22/02

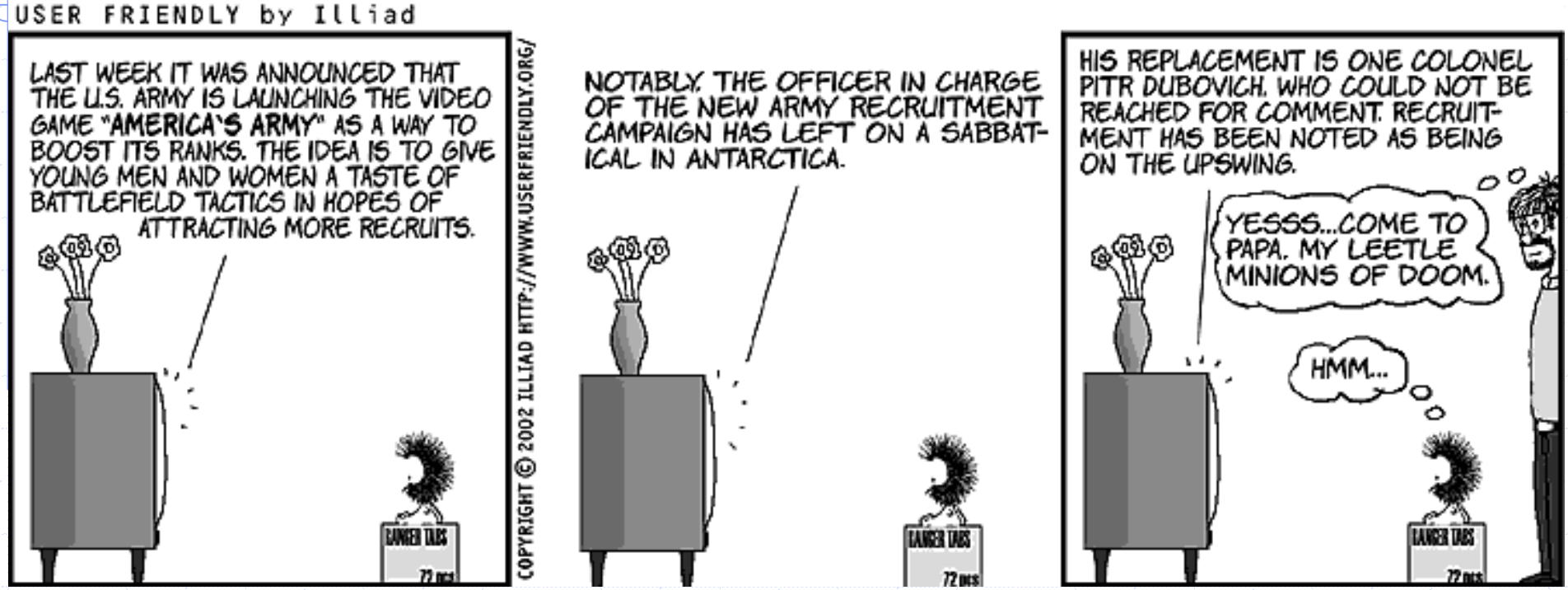
USA Today, "Army gives new meaning to war games — on a PC"by Marc Saltzman 5/22/02

Wall Street Journal, "Videogame Players to Get Look at Life in the U.S. Army," by Patrick Maio, 5/23/02

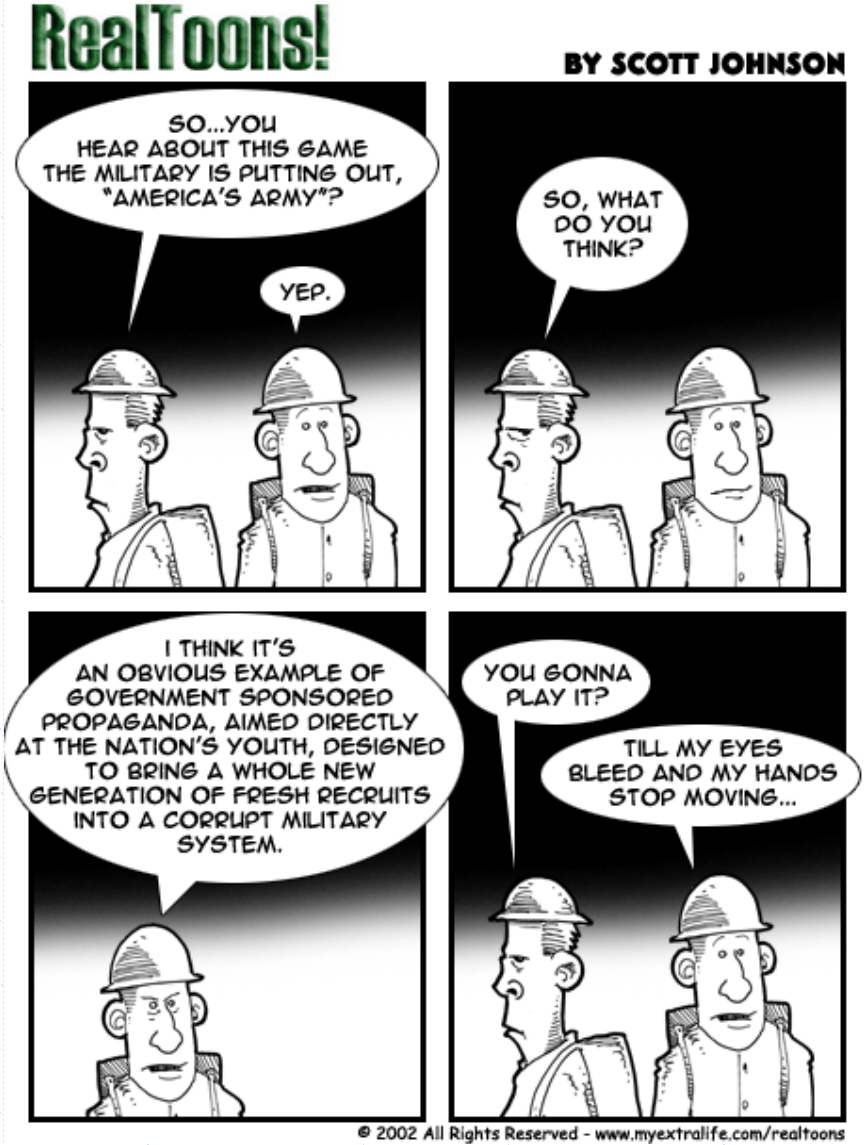
Washington Post, "A Chance to Be All That You Can Be— In a Virtual Army" by Jeff Adler, 5/23/02

Washington Post, " Army Recruiting Through Video Games," by Anthony Breznican, 5/23/02

Popular Culture



Popular Culture …



On


ABOUT THE SHOW
CAST & CREW
EPISODE GUIDE
ROBBERY HOMICIDE DIVISION
EPISODES :
Mini-mall
Mini-mall
Chaos is evident when Cole and his team arrive at a mini-mall to find a veteran cop shot dead and his trainee in critical condition. Control over the scene is threatened by volatile cops who have lost two of their own and by press choppers overhead. Cole takes over the investigation and returns the focus back to finding the real shooter before he slips away.
SCROLL
SCENE FROM:
Mini-mall
select an image
UNIVERSAL
CBS
USA NETWORK
©2002 Universal Studios. All Rights Reserved.
Terms of Use
Privacy Policy

Video

Operations Single Player

Operations Missions

Soldiers

Production Shots

Born on the 4th of July 2002 …

The MOVES Institute
Naval Postgraduate School

On July 4 at 12:01am, the first ten levels of "America's Army: Operations" were posted to the Internet, and by noon the next day, 500,000 downloads of the 211MB game had been made.

- 750,000 hits/second for 4 & 5 July 2002!
- The Army's 140 servers were swamped, and we rushed to complete and post the community server kit the same week.

Community servers everywhere …

By July 15, we were seeing approximately 1,900 servers.

By August 21, 6,500 servers.

- 26 players per server …

As of 12 Aug 2002

The MOVES Institute
Naval Postgraduate School

Game use as of August 12 saw:

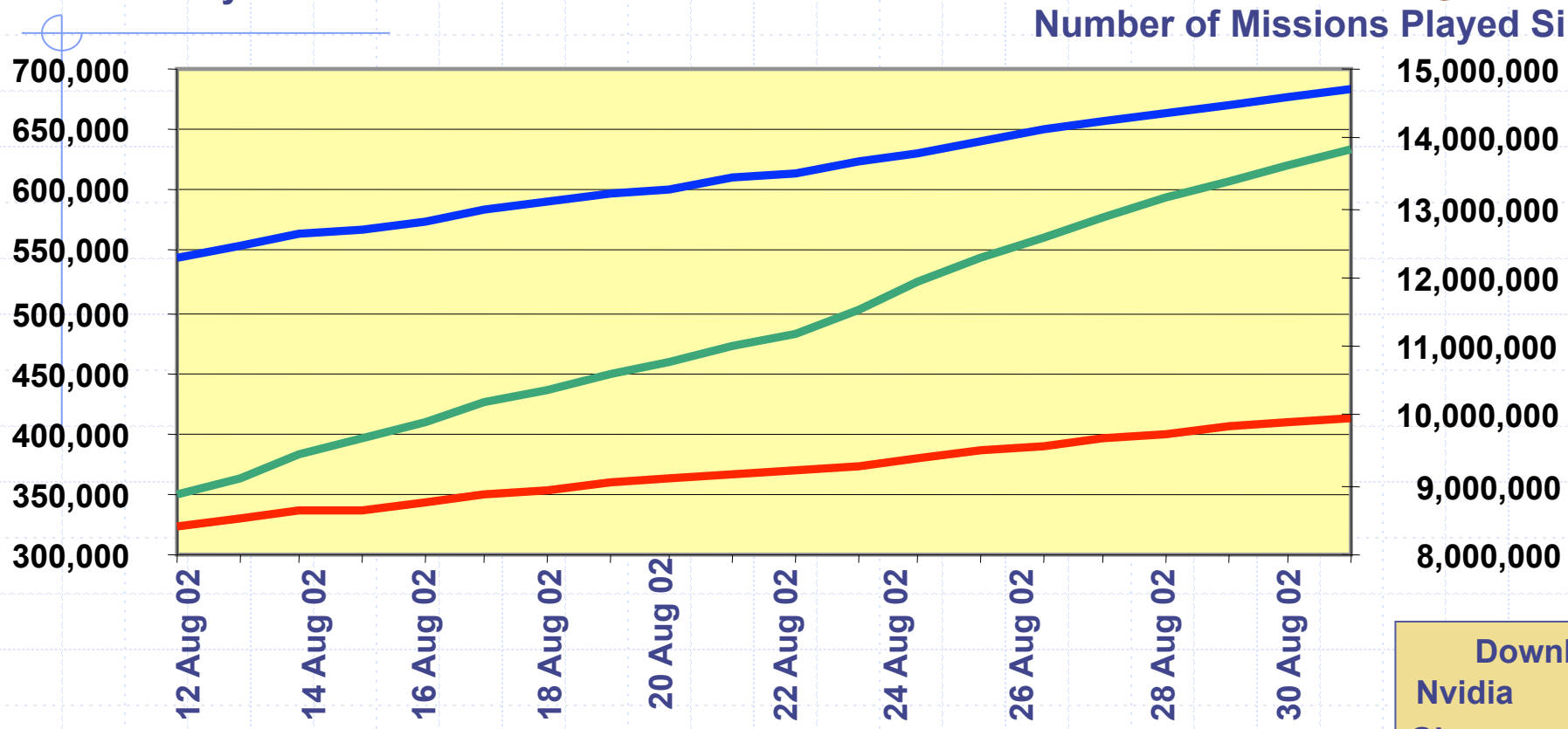
- 545,702 registered accounts,
- 322,860 graduates of BCT, and 8,855,361 missions completed (averaging 6-10 minutes).
  - 1,500,000 hours, 62,500 days, 171 years of play in 40 days (@10min/mission)
  - Per year - 1560 years of game play …

Missions per day averaged 253,010, with players typically accomplishing 21 missions after BCT.

One avid player enacted 3,600 missions in the first 40 days of launch, spending ten or more minutes at each level.

With Registration of Over 683,000 Players Since 4 July 02, Player Registrations and Total Missions Played Continue to Exhibit Exponential Growth

The MOVES Institute
Naval Postgraduate School



Downloads	
Nvidia	1,367,176
Gigex	651,319
File Planet	354,537
Game Spot	65,129
Various	70,000
Total	2.5 million +

30 August 2002

As of 31 August 2002

The MOVES Institute
Naval Postgraduate School

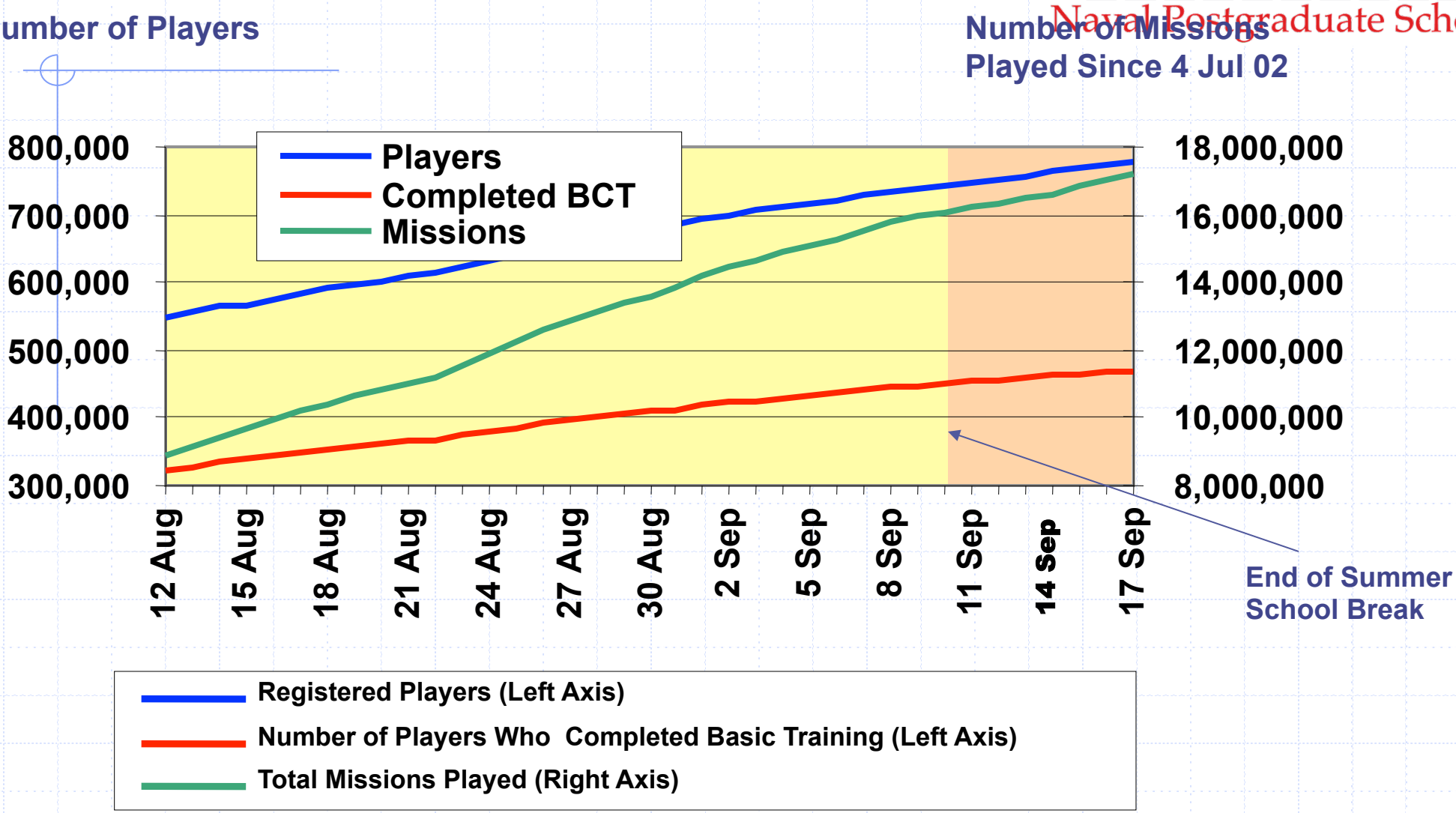
Game use as of August 31, 2002:

- 683,898 registered accounts,
- 412,830 graduates of BCT, and 13,858,106 missions completed (averaging 6-10 minutes).
  - 2,309,684 hours, 96,237 days, 263 years of play in 58 days (@10min/mission)
  - 4.6 years of play per day.
  - Per year - 1659 years of game play (at $6.75/hour, this is about $98M)


AMERICA'S ARMY
AMERICA'S ARMY
americasarmy.com
THE OFFICIAL ARMY GAME
What is it?
The U.S. Army has developed a highly realistic and innovative PC video game that puts you inside an Army unit. You'll face your first tour of duty along with your fellow Soldiers. Gain experience as a Soldier in the U.S. Army, without ever leaving your desk.
Where can I get it?
Downloads for users available now. Visit www.americasarmy.com for more information.
Close Window

The America's Army Game Continues to Exhibit Strong Growth in Player Registrations, Players Completing BCT and Daily Play Activity

The MOVES Institute
Naval Postgraduate School



17 Sept 2002

How much time is 18M missions?

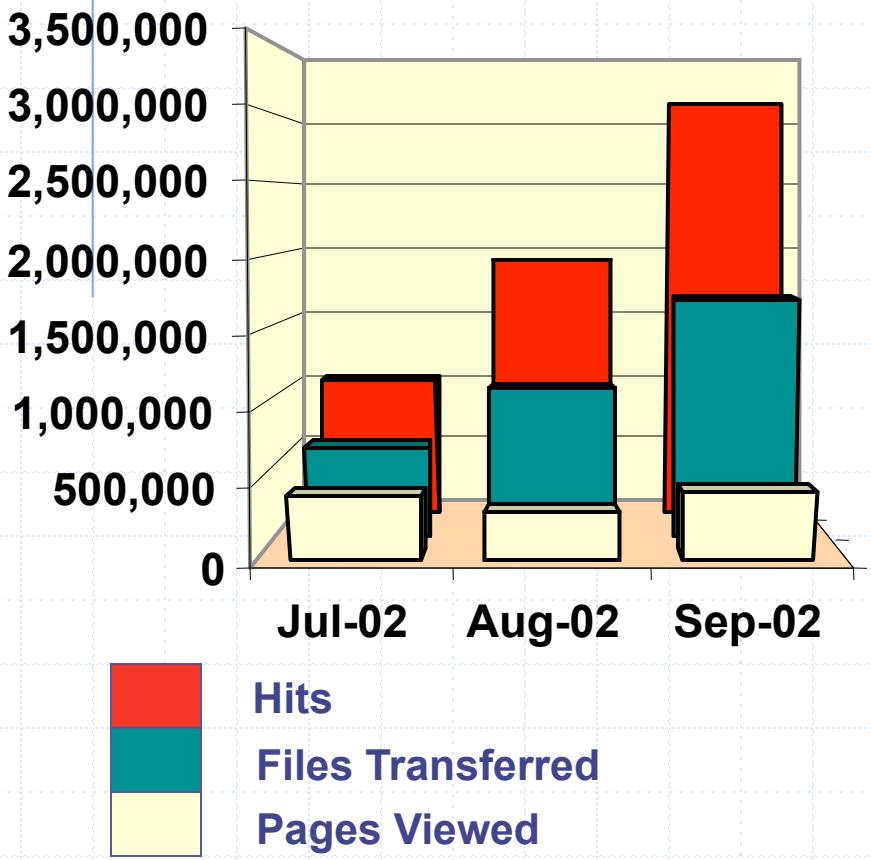
18M missions, at 10 min/mission by 17 Sep 2002

- 3M hours
- 125,000 days
- 342 years of game play in 75 days
- 4.6 years of play per day
- 40,000 hours of game play/day
- 40,000 hours/day x $6.75/hour = $270,000/day or $98M/year

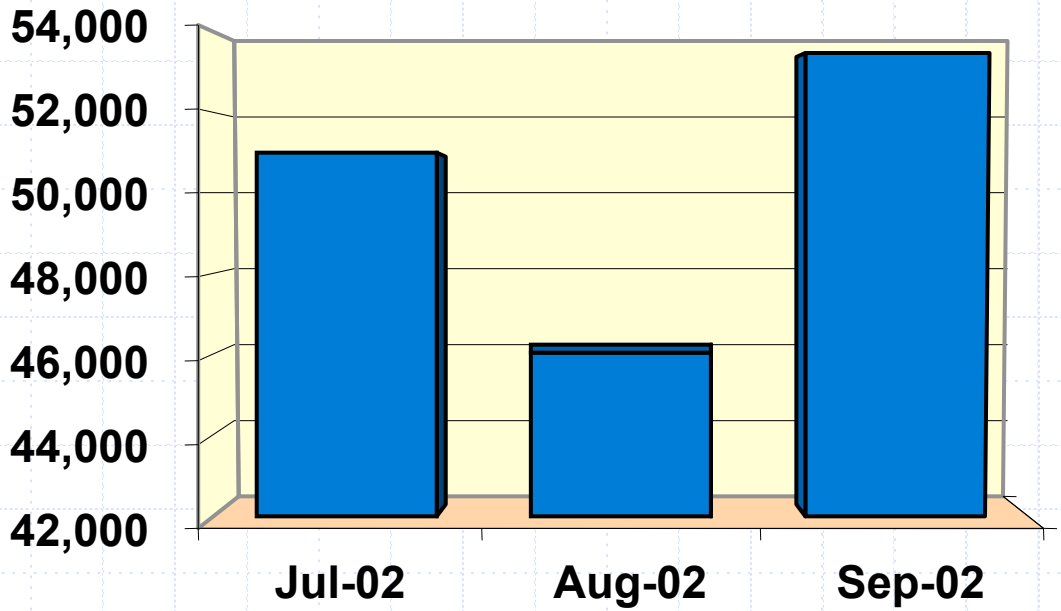
Traffic on the www.AmericasArmy.com Web Site Continues to Expand Apace with the Growth in America's Army Game Activity – Building a Community of Interest About the U.S. Army

The MOVES Institute
Naval Postgraduate School

www.AmericasArmy.com
Average Daily Web Site Traffic



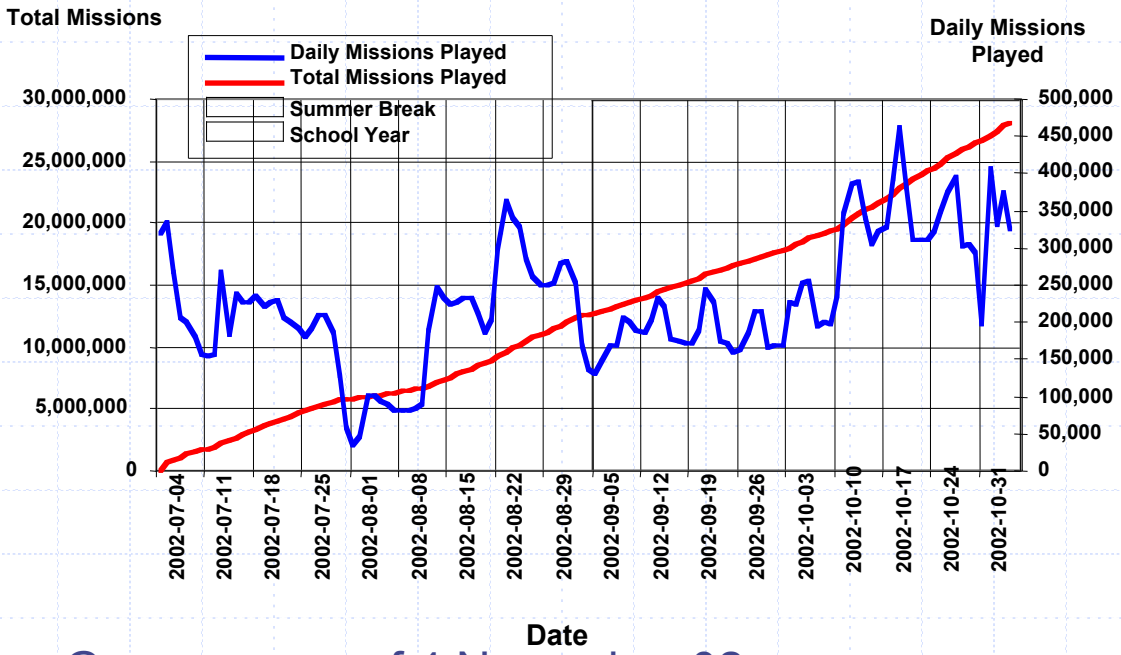
www.AmericasArmy.com
Average Daily Web Site Visits



4 Nov 2002 Status

The MOVES Institute
Naval Postgraduate School

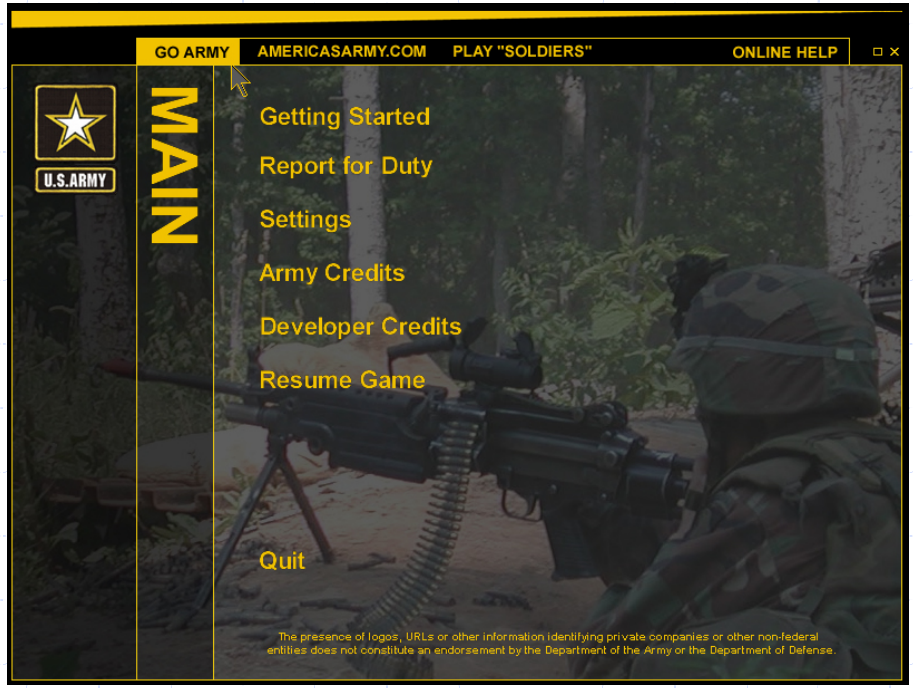
"America's Army" Continues to Exhibit Growth in Daily Play Activity.
Also, the Pattern of Play Activity Fits with a Significant School-Age Player Base.



User Statistics: Game use as of 4 November 02
Registered game user accounts: 968,387
Players that have completed Basic Training (BCT): 589,050
Total completed missions (6-10 minutes in length/mission): 28,149,010
Average completed missions per day: 338,380

GoArmy.com!

Though the Army has used www.goarmy.com as a recruitment site for years, traffic is way up—about 28% of hits now originate from the "America's Army" game.



CD Distribution …

- PC Gamer - Oct 2002
- Computer Gaming World - Oct 2002
- nVidia.com with every GeForce card sold, 1M/month.
- Some 10M CDs will be distributed between October and December 2002
- Recruiting stations, of course

CD Distribution - 10M by Dec 02!

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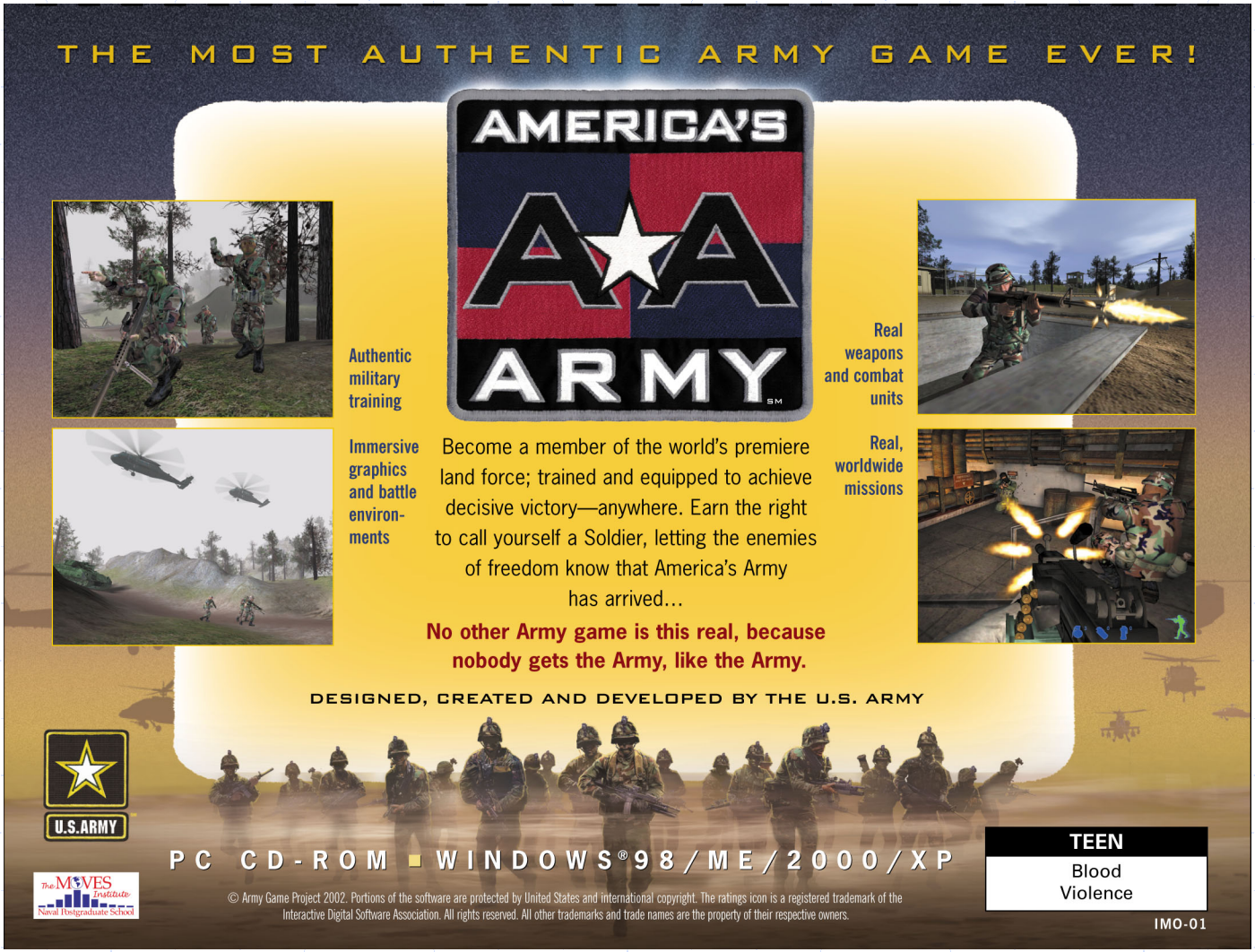
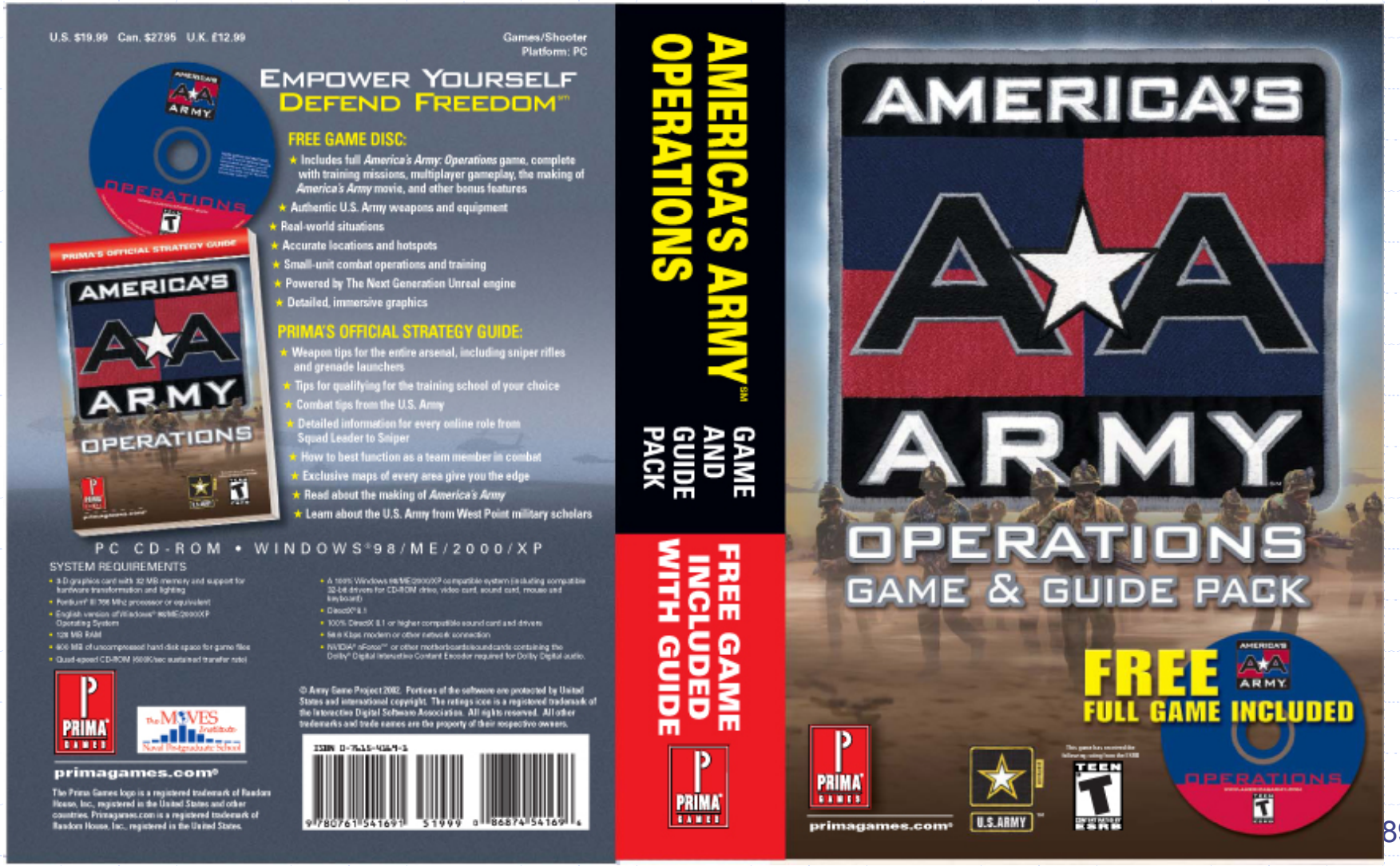
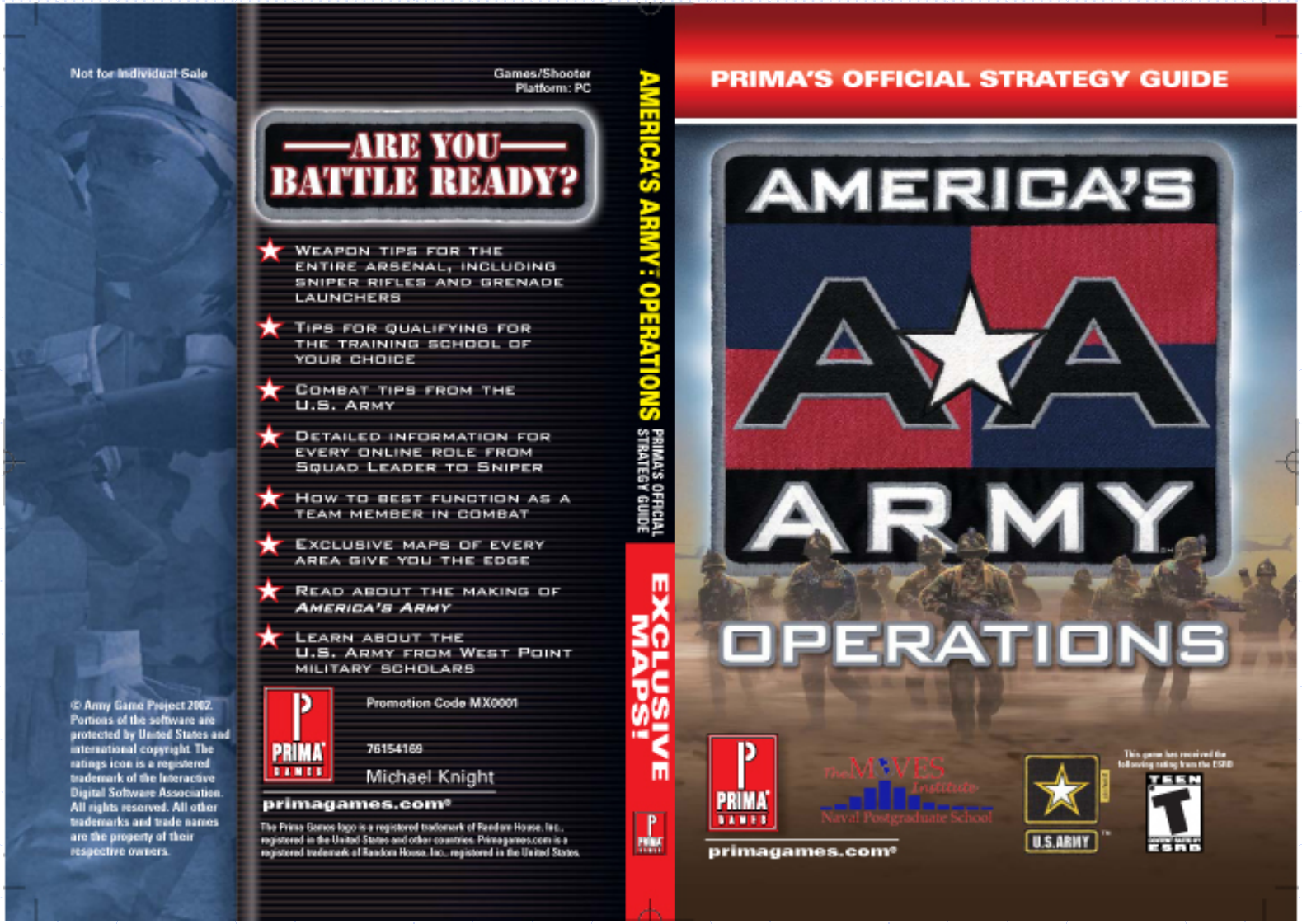
CD Distribution



Strategy Guide Box



Strategy Guide



October 2002 - IGN Awards

The MOVES Institute
Naval Postgraduate School

IGN.COM EDITORS' CHOICE AWARDS

The IGN Editors' Choice Award is a sign of excellence reserved for only the best products. The award signifies excellence in entertainment value, performance, design, originality, and lasting appeal. A product bearing this award has our unequivocal recommendation and is sure to become a classic in its field.

game title	genre		rating
NHL 2003	Sports	Buy Now	8.8
No One Lives Forever 2	First-Person Shooter	Buy Now	9.0
Unreal Tournament 2003	First-Person Shooter	Buy Now	9.0
America's Army	First-Person Shooter		8.8
Battlefield 1942	First-Person Action	Buy Now	9.3
Emperor: Rise of the Middle Kingdom	Strategy Simulation	Buy Now	8.8
The Thing	Action Adventure	Buy Now	8.5
Icewind Dale II	RPG	Buy Now	9.0
Mafia	Third-Person Action	Buy Now	9.2
Medieval: Total War	Strategy	Buy Now	8.9
Madden NFL 2003	Sports	Buy Now	9.2
Warcraft III: Reign of Chaos	Real-Time Strategy	Buy Now	9.3
Shadow of Destiny	Adventure		8.7
Age of Wonders 2: The Wizard's Throne	Strategy	Buy Now	8.5
Neverwinter Nights	RPG Online	Buy Now	9.0
2002 FIFA World Cup	Sports	Buy Now	9.3
The Sum of All Fears	First-Person Shooter	Buy Now	8.7
Grand Theft Auto III	Action	Buy Now	9.4
Baseball Mogul 2003	Sports Simulation	Buy Now	8.9
Soldier of Fortune II: Double Helix	First-Person Shooter	Buy Now	8.8

Invitation to speak

The MOVES Institute
Naval Postgraduate School

Academy of Interactive Arts & Sciences
February 2003 at the DICE Conference

Next Up …

AGP Futures

Having this type of project in-house is kind of like having your own particle accelerator, lots of projects walk in the door to utilize your hard to reproduce capability …

- The Defense Science Board Summer 2001 study, being implemented now, puts us in the center of funding action.
- DARPA & OSD MMP Efforts …

From the ASA M&RA, we have five additional years of promised funding.

We anticipate new missions, levels, completely new games, and more entertainment R&D in the pipeline.

Future Apps

- Treaty Verification - VISIT Program
- AF - Force Protection
- JFCOM
- Army Objective Force
- Infantry Training
- Secret Service WH Protection
- WMD Recovery Trainer

Some potential future research …

What if you did compute the aptitude of each player?

- Akamai & IP addresses - could visually display who is playing where & their aptitude.

Could think about tracking game play of your player pool to look for superior strategies …

Some open issues -

- Would like a more capable, available engine. A govt.-owned, open source one would be excellent.
- Would like to be able to rapidly prototype ANY TYPE of mission.
- Large-scale interoperability.
- Modeling human & organizational behavior integration.

Additional News

MOVES Institute Space

The MOVES Institute is distributed across several buildings on the NPS campus.

Spanagel Hall (second floor)

- Software Development Laboratory
- Conference room
- Video editing facility
- Faculty/staff offices

MOVES Institute Space

and the Mechanical Engineering (ME) building (second floor,labside).

- The Army Game Project Lab
- Conference Room
- Software Production Facility
- VR CAVE & Sound Research Facility
- Faculty/staff offices

MOVES Institute Space

The MOVES Institute
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We will receive the top two floors of the three-story ME annex, providing additional square feet to

- consolidate faculty/staff offices (so we can move out of Spanagel),
- classrooms of the MOVES Institute.
- Space move-wise, it is one-for-one with our office & conference room space with what we have in Spanagel now.
- Need to maintain space in ME Lab side as there is no lab space in the new annex.
- opening is scheduled for March 2003.

Other news of the year

The MOVES Institute
Naval Postgraduate School

- MOVES Institute Open House
- XMSF Workshop
- Threat Assessment Prediction Workshop
- Army SMART Presentation on the Future of M&S Education
- NRC Participation
- And many, many other things …

Visitors

Many visitors -

- Secretary of the Army
- In-Q-Tel
- SPAWAR
- CIA
- NSA
- IDA
- DARPA IAO …
- Army Objective Force
- Fort Benning Infantry school

Other news …

2003 ACM SIGGRAPH Symposium on Interactive 3D Graphics

http://siggraph.org/i3d

In closing

http://movesinstitute.org

Backup slides

The MOVES Institute
Naval Postgraduate School

Academic Program

The Modeling, Virtual Environments and Simulation (MOVES) MS and PhD Programs

Academic Program

The MOVES Institute
Naval Postgraduate School

The MOVES MS degree program is about one third Operations Research, one third Computer Science, and one third MOVES specific course material.

Scope of the MOVES MS Program

The MOVES Institute
Naval Postgraduate School

Programming

Object-oriented programming, data structures, artificial intelligence

Systems & Architecture

Computer systems principles, operating systems, distributed operating systems

Computer Graphics

Computer graphics, image synthesis, computer animation, computer graphics using VRML

Visual Simulation Track Human Performance Engineering Track

29 classes total in the MOVES MS

Mathematical Fundamentals

Multivariable calculus, linear algebra, probability & statistics

Communications & Networks

Network communication in simulation, virtual environment network & software architectures

Virtual Environments

Virtual world & simulation systems, human factors of virtual environments, training in virtual environments

Modeling & Simulation

Stochastic models, system simulation, simulation methodology, introduction to joint combat modeling, physically-based modeling, agent-based autonomous behavior for simulations

Human Performance Engineering

Interactive computation systems, human performance measurement, human performance evaluation, human factors in system design

Subspecialty definition

The MOVES MS program is

- the definition for the Navy's subspecialty (6202/xx99 P-code) in modeling and simulation,
- the definition for the Marine Corps' modeling and simulation subspecialty (MOS 9625), and
- the definition for the US Army's Simulation Operations functional area (FA-57).

MOVES PhD Program

The MOVES Institute
Naval Postgraduate School

PhD Areas of Study

- Physically-based modeling for virtual environments
- Networked virtual environments
- Human factors in virtual environments
- Adaptable software agents
- Modeling human and organizational behavior
- Discrete-event systems modeling
- Data and model visualization